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IMPROVEMENT IN OUTLOOK.

It is probably true that no great improvement can come in industrial and business conditions until the tariff agitation is settled by the adoption of a new tariff. It is possibly true also that the expectancy of any marked change in the tariff will be disappointed, so that the tendency to delay in making new commitments is hardly justified to the full. One element that will help is the inaugural address that may be expected from President Taft, reassuring the country as to some kind of rest from the ceaseless turmoil and anxiety of the past four years. Public utilities have had about all the harassment they can stand. The newer tone of Congress is heard in the expressions of the adverse report of the Senate Committee on the Fulton bill for increasing the powers of the Interstate Commerce Commission. It says truly: "The country is now demanding repose in its industrial upbuilding. It is not a time to experiment and to change the basis upon which the former acts to regulate commerce have been predicated. The recent laws passed by Congress, so greatly enlarging the authority of the commission, should, before changes are sought, have the opportunity of at least a fair trial as to the value of their provisions of the regulations of interstate commerce." That certainly means much, reinforced by its endorsement from the "man higher up."

Meantime we are glad to note in our own pages the symptoms of coming activity and greater cheerfulness. The sap is stirring in the leafless trees. Our industrial construction news in the issues of Feb. 4 and 11 contained no fewer than 490 news items, all of which indicated the early exercise of purchasing power. Of these no fewer than 138 referred to new incorporations, of which 27 were definitely light and power, and electric railway 11. Among the other items no fewer than 237 dealt with electric lighting plans, extensions, etc., and 11 with combined lighting and railway work, while 65 were distinctively electric railway. In the aggregate this stands for a considerable volume of new work, and is in itself a notable cause for encouragement to manufacturer, engineer and supply house.

NEW STATION WORK OF THE BOSTON ELEVATED.

The Boston Elevated occupies a somewhat unique position in that it has steadily pursued the policy of working from a group of allied stations rather than from a single great plant via transmission lines. By and large this policy has produced good results, and we very much doubt whether, all things considered, any plant of the latter class burning coal at a similar price is delivering power at the cars any more cheaply. In following this policy the Elevated plants are very generally equipped with large reciprocating engine sets. Although experiments more or less successful have been tried with direct-current turbine sets and with gas engines, there are no signs of their

adoption on any extensive scale, so that whatever the real success of these experiments, one must regard the big engine sets as the backbone of its power supply. Its latest addition to its capacity consists of four 2700-kw sets of extra large overload capacity distributed in the stations where they will do the most good—two at the Lincoln Wharf plant and one each in the Harvard plant and the Charlestown plant. The accomplishment of this installation without at all interfering with the regular service has demanded a great deal of skill, but the feat has been successfully accomplished nevertheless.

It is worth noting that the engines used follow in design the lines of rolling mill practice in which enormous overloads must be cheerfully carried on no notice at all, and which demands handling sustained 50 per cent overloads without material drop of speed. Backed by big watertube boilers, these engines are apparently capable of dealing with any emergencies likely to be encountered. The generators are somewhat interesting on account of the large adjustment possible in the compounding, ranging 10 per cent, both above and below constant potential performance, the lowering being sometimes desirable to keep them from taking an undue share of load from the other stations. The potential regulation on this system has been very thoroughly studied and is very successfully carried out. The guaranteed efficiency is high, reaching 94.8 per cent at full load and an even 94 per cent at the 50 per cent overload. In one instance the new generator is driven by a vertical cross-compound engine of special form, and is itself of the interpole form, making a unit very interesting in view of the very high efficiencies guaranteed. The engine is to do its full load at a steam consumption of 12.5 lb. per horse-power at 50 deg. superheat, and the generator is guaranteed at 95.5 per cent full load efficiency. There is a good deal to be said for interpole machines for railway work and if this one makes good, as it doubtless will, it will be invaluable from the operative standpoint, since its power of standing hard pounding without a spark is extraordinary. It would be interesting to conjecture as to what net efficiency this set would show were the engine designed for high superheat. Superheat is the one improvement that has been rather neglected on this side of the water in spite of some remarkable results obtained abroad. The installation of these new sets has involved some interesting details of construction worth studying in the description given. The Boston Elevated seems to have taken time by the forelock in this instance, and to have provided a powerful and business-like equipment that should keep it out of trouble from power supply for at least a season or two to come. From the standpoint of technical operation it is remarkably well managed, and its plants, while designed along lines now rather unusual, have shown admirable performance in a way that fully justifies them by results.

Sparking Voltage Between Commutators and Brushes.

The great complexity of the actions which occur during commutation under the brushes of a direct-current dynamo make the complete explanation of the phenomenon difficult. Designers of direct-current dynamo machinery have long been accustomed to overcome difficulties due to sparking at the commutator, by following rules arrived at experimentally, through experience with preceding machines. It is known that when sparking occurs at commutator brushes there is produced a phenomenon bearing certain resemblances to the carbon arc lamp. In order to produce a satisfactory voltaic arc between carbon points in air, it is necessary to have a certain critical voltage between them. Below this voltage no arc can be maintained. Above this voltage, an arc can be maintained, but the power of the arc will depend upon the electric power liberated in the arc. In a somewhat similar manner, in order that there shall be arcing at a dynamo commutator, there must be a certain critical voltage at rupture between the brushes and the commutator segments. Below this voltage there will be no arcing. Above this voltage there will be arcing, but the intensity of it will depend upon the amount of electric power liberated per unit of brush contact area.

As mentioned in the Digest, the *Elektrotechnische Zeitschrift* has recently published an article on this subject by Dr. J. Liska. The article contains the results of an experimental research on the behavior of a revolving commutator supplied with current from an external source. The conditions differed from those of practice in the fact that the circuit of the brushes was sensibly devoid of inductance. A storage battery supplied current to the commutator through a non-inductive resistance. By this means, however, the voltage across the break was prevented from rising inductively. It was found that if the voltage between brush and commutator was less than a certain critical value, sparking did not occur, but that above this value sparking set in. The value of this critical voltage depended upon the direction of the current. Thus, with certain carbon brushes, when the current was from brush to commutator, the critical pressure was 14.5 volts; but with the current from commutator to brush it was 22.5 volts. This phenomenon throws light on the fact sometimes observed that the negative brushes of a machine may give more trouble than the positive.

Inductance Coils Used in Wireless Telegraphy.

In order to tune wireless telegraph conductors into syntony, it is necessary to alter either their inductance or their capacity, or both. This necessity has stimulated the development of the adjustable induction coil and of the adjustable condenser. The adjustable condenser has chiefly followed the construction of the Kelvin multicellular voltmeter. The adjustable induction coil has followed different paths. The different types of construction in variable induction coils is illustrated by Mr. J. L. Hogan, Jr., in his article on page 450 of this number. They may be divided into three main classes as follows: (1) Fixed coils, with variable points of contact, including the types of Figs. 1, 2, 3, 4, and 5; (2) two fixed coils movable with relation to each other, including the Ayrton-Perry and Stone constructions of Figs. 7 and 11; (3) coils of variable winding, comprising the Fessenden double-roller of Fig. 6.

As pointed out in the article, the advantage of the first type of construction is its mechanical simplicity. Such coils are easy to construct, and are mechanically strong. The difficulty which they present is the chance of poor contact at the slider or sliders. The advantage of the second type lies in the absence of rubbing contacts and in the continuous variation of inductance which they permit. A disadvantage to which they

are liable is defect of range, because under no condition does the inductance of the device fall to zero. It merely permits of being varied between a certain minimum and the maximum. The third type has no necessary rubbing contacts, and has full range of inductance variation, from zero to the maximum, by continuous increase. The main disadvantage lies in its relative expense, as such devices have to be constructed carefully. A disadvantage mentioned in the article is that the double roller does not permit of rapid variations. In practice, however, rapid variations are readily made by means of a traveling contact, like those used in devices of the first type, held in the hand, so as to cut out any desired number of full turns. As regards the second objection mentioned in the article, of loss of energy in the short-circuited element, this seems overrated. In a complete metallic cylinder of copper, the current necessary to set up a central magnetic field is relatively small, and therefore the power expended as I^2R by this induced current, in order to cancel the inductance of the primary, is also very small. This objection would become serious in cases where the secondary resistance was great.

It is a curious fact that none of the variable inductances thus far introduced attempts to introduce equal changes of inductance with equal mechanical displacements. In devices of the first type, the inductance varies something like the square of the number of included turns. In devices of the second type, the change of inductance per unit of movement is often very complicated, and is far from being uniform. In devices of the third class, it varies again roughly as the square of the number of turns; but the deviations from the rule are considerable. An ideal device would, like a rheostat, include equal variations for equal displacements. Strictly speaking, whenever a receiving aerial is tuned to syntony by means of added inductance, reflection losses are involved by the insertion of this inductance in a single lump at the foot of the aerial. It would seem desirable to increase the efficiency of the added inductance by distributing it; and, inserting a number of small inductances at intervals in the vertical conductor, would be one way of effecting distribution. Another way would be to suspend the aerial like a long spiral spring from the top of the mast, keeping the distances uniform between successive turns by insulating cords. This plan would certainly distribute the extra inductance nearly uniformly. In both of these cases, however, the extra inductance would not be amenable to variation, and would therefore only be applicable to predetermined increase of total aerial inductance, with the opportunity for a relatively smaller adjustment in a regulator at the base of the aerial.

WIRELESS WATER CONTROL.

A recent newspaper paragraph recounts the wonders of a French invention for the wireless control of submarine boats; still another exploits in a fine frenzy of imagination the awful possibilities of dynamite-laden airships directed on their terrible mission by similar means; and the Patent Office would disclose many another such scheme for similar stunts. Now, we do not at all wish to discourage the inventors or to throw cold water on their very ingenious plans for general annihilation, but in the interest of an all-too-credulous public which may be asked to invest its cash in this sort of thing it is only fair to call attention to a few of the very practical difficulties that stand in the way of success. As a mere matter of engineering it would be, and doubtless is, possible to arrange for wireless control of a submarine boat with a not inconveniently long-exposed antenna. Wireless control, however, implies, like control from a running cable, the doing of several things that demand a somewhat complex switching arrangement. At the very least a submarine torpedo of the automobile variety must be able to stop, start and turn to starboard or port. These rudimentary requirements demand that it should be kept at proper submergence by means of a float, else in addition one would have to install automatic submergence devices like those of a Whitehead, working accurately enough to keep the horizontal plane without submerging antenna or markers. In addition, one point of the control ought to fire the charge, if necessary, without depending entirely on a fair blow, in order to give a chance for cutting nets.

Now a switchboard for doing these things must either be selective by steps or by tuning. The former is easy enough if there is no interference; the latter in the present state of affairs, exceedingly difficult. And granting the possible working of either, the chief practical difficulty of the automatic submarine is not yet touched at all—to wit, the extreme difficulty of seeing what one is about in steering it. Even at the short ranges attempted by torpedos steered by a cable, the markers, unless exceedingly conspicuous, are very difficult to follow and align, and anything out of a straight course is almost impossible to follow with any respectable chance of making a hit. Even if a submarine could be directed by wireless at war-time ranges, say from three to six miles, as may be quite possible, the chance of correct steering would be almost infinitesimal and manoeuvering for a hit quite out of the question. In the case of the aeroplane or dirigible balloon, accurate location at a distance horizontal or vertical, great enough to be of any use, is nearly out of the question, especially if the speed is high enough to give a chance of escape from gun fire. A shrapnel loaded with tiny carcasses is capable of putting any balloon out of business in short order, and even a fast-moving aeroplane could be caught and disabled rather easily at any time when there might be light enough by which to steer it. This mere difficulty of location is sufficient to prevent the successful use of such devices even if they were technically well worked out. And even high explosives must be well placed to be of any destructive value. The work of the *Vesuvius* in front of Santiago is enough to attest the general inefficiency of this kind of offense. When high explosive shells are delivered from big guns and hit, the results are terrific, as in the Battle of the Sea of Japan, but one can sling around dynamite by the hundredweight and accomplish absolutely nothing unless by a chance hit. So the present purveyors of distinction will have to guess again before they make a practical weapon of such sort. One well-handled 12-in. gun is more to be feared than a whole fleet of wireless-steered torpedoes, aerial or submarine. As to aerial weapons, it is interesting to note that Mirabeau in a work on the American Cincinnatus Society, published prior to the French Revolution, referred to the use of balloons for military purposes, adding that they might prove to be one of the agencies which, through their great potentiality of destroying life, would eventually render war too fearful to be considered by the nations of the world.

Meeting of the American Association of Electric Motor Manufacturers.

The winter meeting of the American Association of Electric Motor Manufacturers was held at Hotel Schenley, Pittsburgh, Pa., Jan. 26, 27 and 28, 1909, and was attended by 52 members and 10 guests. The papers presented at the convention were as follows: "Ratings and Guarantees of Alternating-Current Motors," by Mr. R. S. Feicht; "Temperatures on Semi-Enclosed and Enclosed Motors," by Mr. J. M. Hipple; "Methods and Cost of Testing Alternating-Current and Direct-Current Motors," by Mr. L. E. Underwood; "Starting Devices for Alternating-Current and Direct-Current Motors," by Mr. H. D. James; "Standard Voltages," by Mr. P. M. Lincoln; "Relation of the Association with Central Stations," by Mr. Fred. M. Kimball; "Relation of the Association with Other Manufacturing Associations," by Mr. Charles Robbins; "Unprofitable Advertising," by Mr. Rodman Gilder. Abstracts of several of these papers are printed elsewhere.

On Tuesday evening a pool and billiard tournament was held. The pool tournament was won by Mr. H. H. Smith, Chicago, manager of the Diehl Manufacturing Company, and the billiard tournament by Mr. R. C. Kellogg, of the Mechanical Appliance Company, Milwaukee, Wis. The prizes were a billiard cue in a leather case for each contest. On Wednesday afternoon, Jan. 27, the members left Hotel Schenley on special cars for the Westinghouse Electric & Manufacturing Company's works at East Pittsburgh, where luncheon was served, after which the works were inspected. On Wednesday evening the association dinner was held at Hotel Schenley and was a most enjoyable affair, music and songs being substituted for speeches. The annual convention of the association will be held at Hot Springs, Va., May 17 to 20, 1909.

Progress in Telephone Regulation in Nebraska.

Although the Nebraska Railway Commission is given, under the statute, ample power of regulation over both the rates and service of telephone companies, it has during the past year been proceeding somewhat cautiously in the exercise of its powers. It has in several cases prescribed changes in rates on its own motion, and has authorized changes on application from telephone companies. In most of the cases coming before the Commission it has been found that a raise in rates was essential and it has been put into effect with the Commission's consent. In one case the Commission has ruled that the "Burlington" Railway shall install a telephone in one of its stations, as a public necessity, and pay for it, but there will probably be no further ruling on new cases of this type until the courts have rendered a decision upon the one which has been made.

The Commission is now making plans for a broader exercise of its powers, and intends particularly to establish a general supervision and control of rates, and also of interchange of service between connecting companies.

There was held, at the time of the recent convention of the Independent Telephone men, a public session of the Commission, at which Chairman F. Clarke presided, for the discussion of a number of topics associated with accounting, rates, interchange of service, etc.

This hearing was attended by about 75 representatives of the Independent companies and by President C. E. Yost, of the Nebraska Bell Telephone Company, and F. A. Pickernell, assistant to the president of the American Telephone & Telegraph Company, who spoke for the Bell interests. Mr. Pickernell called attention to the many difficulties of putting into effect a system of accounting which will afford accurate information on the investment and cost of maintaining and operating individual telephone exchanges, and stated that the bookkeeping department of his company did not contemplate any such divisions, as they are believed to be impracticable on the score of accuracy, and unduly expensive. The Railway Commission will, however, in all probability, put into effect a system of accounting which will enable it to obtain, for each exchange district, such figures as it considers necessary for the individual determinations of equitable rates.

It was brought out at this hearing that the Independent telephone companies are opposed to anything but the most rigid classification of service under business, residence, and farmers' rates, and expect the Commission to aid them by prohibiting reduced rates which have heretofore prevailed for telephones in railway stations, lodge rooms, schools, homes of company directors, etc.

The subject of physical connection, of competing lines, although scheduled for discussion, was not taken up, and the Commission seems to feel that the general enforcement of such a measure would be dangerous.

At the present time, methods of bookkeeping which may be uniformly adopted and a corresponding form for reports to be made to the Commission, are being devised by the Railway Commission, in co-operation with representatives of the Bell and Independent telephone companies.

The Latest American Telegraph Statistics.

The Bureau of the Census, Washington, has just issued the preliminary report on the telegraphs of the country, i. e., for the continental United States, exclusive of Alaska, Hawaii, Philippine Islands and Porto Rico. The statistics relate to the years ending Dec. 31, 1907 and 1902. The totals include reports of commercial land telegraph companies owned and operated within the United States, and of domestic ocean cable companies operating from the United States, but do not include telegraph lines operated by railway companies.

	1907.	1902.	Per cent of increase.
Number of systems or companies	[illegible]5	25	0.0
Miles of single wire (exclusive of ocean cable)	1,577,961	1,318,350	19.7
Nautical miles of ocean cable	46,301	16,677	177.7
Messages, total number	103,794,076	91,655,287	13.2
Total income	$51,583,868	$40,930,038	26.0
Total expenses (including taxes, interest and fixed charges)	$41,879,613	$30,948,034	35.3
Total cost of construction and equipment (including real estate)	$210,045,959	$161,679,579	29.9
Capitalization:			
Capital stock authorized, par value	$161,603,900	$123,233,075	31.1
Capital stock outstanding, par value	$155,089,575	$117,053,525	32.5
Dividends on stock	$7,477,083	$6,256,693	19.5
Bonds authorized, par value	$83,004,000	$49,893,000	66.4
Bonds outstanding, par value	$65,204,000	$45,893,000	42.1
Interest on bonds	$2,651,511	$1,949,150	36.0
Total par value stock and bonds outstanding	$220,293,575	$162,946,525	35.2
Employees and wages:			
Average number	28,034	27,627	1.5
Total salaries and wages	$17,808,249	$15,039,673	18.4

The final report for 1907 will contain an analysis of the above totals and present detail statistics for other phases of the industry.

Electrolytic Condensers for Starting Induction Motors.

In a patent issued on Feb. 2 Mr. Ralph D. Mershon proposes the use of condensers and impedance coils in the secondary circuit of an induction motor for improving the starting conditions. The devices are so adjusted that the current taken by the impedance is equal to that taken by the condenser at starting. At synchronism the currents in both devices will be zero, but at speeds slightly below synchronism the current in the impedance may be high while that in the condenser will be small. Under running conditions, therefore, the operation of the motor will closely approximate that of one with a short-circuited secondary, but at starting the machine differs from one of the usual type in that the secondary current will be practically in step with the e.m.f. The inventor suggests the use of electrolytic condensers on account of their low e.m.f., the high loss not being a disadvantage.

Annual Report of Wisconsin Commission.

The second annual report of the Railroad Commission of Wisconsin, relating to its work in connection with public utilities and railroads for the year ended June 30, 1908, has been issued.

It is shown in the report that the total amount expended under the railroad commission law was $48,169.77; the amount expended under the public utilities law was $17,513.74, making a total of $65,683.51. The total expense of maintaining the joint engineering staff of the Railroad Commission and the Wisconsin Tax Commission, including salaries and traveling expenses, but exclusive of instrumental equipment, was $31,-199.09, divided as follows: Public utilities, $13,132.50; Railroad Commission, except public utilities, $9,128.82; Tax Commission, $8,937.77.

The report discusses the importance of reliable statistics in connection with the duties devolving upon the commission and describes the preparation of the uniform systems of accounts, saying in part:

"If the purpose of a uniform classification of accounts were but to secure a statement of earnings and expenses of each utility, without regard to the many varying conditions of operation and their details, together with a general balance sheet for each corporation, many of the quasi-technical considerations which arise in connection with each class of utilities might be disregarded, leaving a work of comparative simplicity. But if accounts are to be kept which will enable the management of properties to determine the efficiency of their operations and permit the commission to determine the reasonableness of rates charged for the service performed, the accounts to be prescribed must be such as show the cost of each step or process in the natural order of production, and the final cost per unit of service to the public. Whatever other elements may be considered in the making of rates, the cost of the service is of the first importance.

"With the unit cost as the object in view to be determined from the accounts, attention was directed to the second general consideration—the methods of operation.

"Among the gas companies a number of plants produce only coal gas, some produce only water gas, while others purchase a part of the gas sold or purchase the entire product. An even greater diversity of conditions exists among electric and water companies. Electric current may be generated by steam power, gas power, hydraulic power or the product may be purchased from another electric utility or a manufacturing establishment. Water plants may pump by steam power, gas power or hydraulic power. Any two or all three of these utilities may be furnished by the same corporation, in which case much apparatus and facilities of service are used for the joint benefit of several utility departments. In a large number of plants conditions are rendered still more complicated through the operation of a manufacturing or mercantile business in connection with the utility service, and in the municipally owned plants by a merging of the utility transactions with those of the city. These are some of the conditions under which the public utility business is being operated in Wisconsin and, consequently, any classification of accounts, to serve its purpose and to be a practical working scheme, must be so elastic in its provisions as to recognize these factors.

"The record of the electric plants operating by two or more methods should show the cost per kw-hour at the switchboard of current generated by steam power, as distinct from that generated by any other motive power. The management must know which method or methods of manufacture are the most economical and offer the greatest profits. This information is also essential for the work of the commission.

"Further, unless a separate group of accounts were provided for each method of production, comparisons of results would be misleading, if not impossible. Such comparisons, to be of value, must be made between companies operating under substantially similar conditions. The switchboard cost of electric current generated at one plant by hydraulic power cannot be used to show relative efficiency by comparison with a steam power plant.

"The great variations in size of plants required many concessions to simplify the accounts. The large and completely equipped plants in the metropolis and other large cities of the State, with their technical and specialized labor, require a system wholly impossible to the many small plants which range in size downward to those utilities established and maintained by public spirited citizens, or by the municipality, largely as a matter of civic pride.

"Careful attention was paid to the accounting and operating practices of corporations or municipal plants operating two or more utility services. Since electric plants and water works, when operated by steam power, both require a large boiler capacity or other prime motive power, there is apparent a strong tendency for their combination in the interest of economy. This tendency is most pronounced in the smaller cities, and is best seen in the field of municipal ownership. In the larger cities the tendency is more toward a combination of gas and electric industries, because of the competitive nature of their service. In all such cases of joint operation, in order to determine the cost per unit of service, all joint charges should be apportioned over the different departments according to their demands upon the joint facilities or upon the basis of service received by each."

Discussing the statistical tabulations of operations for the year ended Dec. 31, 1907, the report says:

"There are some companies which have kept a systematic and detailed record of their financial transactions which reflect the most advanced thought on the subject of public utility accounting, and their reports were easily analyzed, but they represent a small minority in the aggregate. Many utilities keep practically no records worthy of the name, while in not a few cases, and even where the services performed are considerable in extent, the most detailed records are found in check-book stubs, pocket memoranda, or the memory of the manager. In some instances office records of considerable detail are maintained, but the methods followed are not always correct. Originally founded on some fundamentals, the system has since been enlarged or condensed to suit the needs of a complex business connection or the personal views of the operators. Revenues from all operating sources and non-operating revenues have frequently been merged, while operating expenses are confused with construction expenses, the accounts often being grouped more for convenience than to enable an analysis of results. The greatest difficulty was encountered in the separation of revenues and expenses by those corporations or municipalities operating two or more utilities, the general practice having been to credit all revenues to a single fund, from which all expenses were paid without regard to the department which occasioned them."

The report then takes up the subject of statistics relating to municipally owned utilities, saying:

"In the lack of separation between the public service properties and other operations, municipalities appear as the chief offenders. The greatest criticism which must be offered against the municipal methods was the merging of public service accounts with those of the city. Revenues which should be credited to the treasury of the utility were turned into the general fund of the city, while the plant's operating expenses were generally paid out of the same city fund, showing no record other than the general entries 'Cash Paid.' While the public plants often received no credit for hydrant service or water for sprinkling service or electric current for street arcs or incandescents, the city paid the interest on the construction bonds, reasoning that this is a fair compensation for the service received. This may be true, but it cannot be proved from the accounts or records of the property.

"The accounts of the municipally owned utility should be affected no more by the transactions in the municipal funds than should the accounts of the private utility reflect the activities of the shareholders. In many cities, especially the smaller ones, the inspection of the distribution system is a part of the

duties of the street superintendent or marshal. Meters are read and often inspected by the same city officials at times when not engaged in other municipal duties, but the public service property is not charged with any proportion of their expenses. The city clerk and his assistants generally furnish, without additional cost, much of the service which is reported by private plants under the head of administrative or general expense. Until a separation of accounts between the two departments is made, a comparison with private enterprise, to determine relative efficiency, is impossible."

On the subject of rates of utilities the report says in part:

"The rates filed by the larger companies are generally based upon scientific considerations, but those of the smaller companies partake of every conceivable form and method of determination. They vary from the simple schedule of but two or three lines to the most elaborate classification of consumers. In a majority of instances there appears to have been no particular system followed in determining the amount to be charged for a given service. The process of reasoning, which in some cities placed certain classes of consumers upon meter rates or upon flat rates, or determined the rates to be paid by certain classes of consumers, seems to have been exactly reversed in other cities. Rates for similar service often vary several hundred per cent in neighboring cities. In a number of instances schedules are in force which make some concession in rates with increasing consumption, but the rates have seldom been determined with regard to the cost of the service. Too frequently the tendency is noticed to copy the rate schedule of another community, with the result that many inconsistencies in charges are passed from city to city. The majority of schedules on file, in the effect of their application, are not calculated to secure the greatest development of service with the consequent reduction in the unit cost."

During the year there were 83 formal complaints, investigations and other formal matters affecting utilities, classified as follows: Rates, 21; application to increase, modify or equalize rates, 42; valuation of property, 13; investigations upon motion of commission, 7. There were also many informal complaints, of which 246 affected utilities.

The corporations named in the table following filed notices of surrender of franchise with the commission and obtained, in lieu thereof, an indeterminate permit.

A portion of the report referring to discrimination in rates for electric service gives the following summary reports of electric companies as to discriminatory rates:

Total number of utilities furnishing electric current	232
Total number of electrical utilities reporting no discriminatory rates	50
Total number of such utilities reporting discriminatory service of some kind	69
Total number of such utilities failing to report in time for this tabulation	113
Total	232

In discussing this subject the report says: "For the companies which reported discriminatory rates, about 3 out of every 100 consumers pay less than the schedule rate. The proportion is not so great as that for telephone companies, but it exceeds that for both water and gas utilities. Because a certain utility has more discriminations in effect than another does not mean in itself that it is following a vicious practice or is using unlawful methods. Most of the discriminations cited are remnants of a former period of unrestricted competition; others are the outgrowth of circumstances over which the utilities themselves had no control.

"No provision of any law has ever struck more directly at evils in utility enterprises than this, nor has anything ever been done in the regulation of quasi-public business in this State which more fundamentally affects the moral sense of the citizens of Wisconsin. In this respect the utilities law has brought about a quiet revolution, just as it is effecting a revolution in the business methods of many of the plants.

"A few discriminations remain, and these are complicated with more or less serious legal questions. The courts may be trusted to dispose of them fairly when the issues shall have been presented. Ample time and opportunity has been given to the respective managements to put their houses in order, and the commission shall proceed promptly against any management which may hereafter be found delinquent in its obedience to the law. We know of no such, and we hope there is none."

Suggestions for legislation are made in the report. An abstract of several of the suggestions follows:

"The administration of the public utilities law has revealed no weaknesses in its essential provisions. The only amendment to the public utilities law which may be suggested is one extending the period of time during which public utility companies, organized before the enactment of the law, can surrender their franchises and secure in lieu thereof indeterminate permits. The utilities law limited the time during which a franchse could be surrendered to July 1, 1908. Since this date a number of companies have inquired of the commission as to the manner in which they could now surrender their franchises. In our judgment it is desirable that utilities, still operating under franchises granted before the enactment of the law, should have an opportunity to surrender the same at any time in the future. Possibly it is in the interest of the public to go a step further and, under the reserve power of the constitution, by statute repeal all franchises still in existence and grant in lieu thereof indeterminate permits. The second suggestion is obviously a much larger proposition, but we are inclined to believe that it merits careful consideration.

"The public convenience and necessity law could to advantage be modified, so as to permit the commission to consider the financial ability of the applicants in passing upon the application for such certificate, as some doubt exists at present of the right of the commission to inquire into such matter. The law might be further amended to authorize the commission to permit modifications of the certificate of public convenience and necessity at any time subsequent to its first issuance.

"We think that the stock and bond law should be amended so as to include telephone companies. The securities of telephone companies can be issued with the same degree of carelessness and consequent injury to the public as the securities of other public utilities have been issued in the past. There is

LIST OF INDETERMINATE PERMITS.

Company.	Location.
Ashland Light, Power & Street Railway Company	Ashland.
Monroe Electric Light & Power Company	Monroe.
Mellen Water & Light Company	Mellen.
Burlington Electric Light & Power Company	Burlington.
Appleton Water Works Company	Appleton.
Milwaukee Central Heating Company	Milwaukee.
City Water Company	Marinette.
City Water Company	Sheboygan.
Menominee & Marinette Light & Traction Company	Marinette.
Mineral Point Electric Light Company	Mineral Point.
Wisconsin Electric Service Company	Chilton.
North Milwaukee Light & Power Company	N. Milwaukee.
Northwestern Iron Company	Mayville.
Dodgeville Electric Light & Power Company	Dodgeville.
Platteville Electric Light & Power Company	Platteville.
Falls Light & Power Company	Sheboygan Falls.
Waukesha Gas & Electric Company	Waukesha.
Equitable Electric Light Company	Lake Geneva.
Portage American Gas Company	Portage.
Cashton Light & Power Company	Cashton.
West Bend Heating & Lighting Company	West Bend.
Washburn Electric Light & Power Company	Washburn.
Darlington Electric Light & Power Company	Darlington.
Racine Water Company	Racine.
Rhinelander Lighting Company	Rhinelander.
Manitowoc Water Works Company	Manitowoc.
Manitowoc Electric Light Company	Manitowoc.
La Crosse Gas & Electric Company	La Crosse.
City Water Works	Merrill.
Medford Light & Heating Company	Medford.
Merrill Railway & Lighting Company	Merrill.
Superior Water, Light & Power Company	Superior.
Lake Geneva Water & Light Company	Lake Geneva.
Minahan Building Company	Green Bay.
Citizens' Gas Company	Burlington.
Plankinton Electric Light & Power Company	Milwaukee.
Wells Power Company	Milwaukee.
Glenwood & Downing Light & Power Company	Glenwood.
Chippewa Falls Water Works & Lighting Company	Chippewa Falls.
Kaukauna Gas, Electric Light & Power Company	Kaukauna.
Kaukauna Gas, Electric Light & Power Company	Little Chute.
Portage Electric Light Company	Portage.
Beaver Dam Fuel & Light Company	Beaver Dam.
Beloit Water, Gas & Electric Company	Beloit.
O. I. Newton's Sons Co.	Sparta.
Viroqua Electric Light Company	Viroqua.
Ripon Light & Water Company	Ripon.
Chippewa Valley Railway, Light & Power Company	Eau Claire.
Campbellsport Electric Light & Power Company	Campbellsport.

nothing in the nature of the telephone business which makes it different from the other utilities in this respect, and we therefore recommend that no telephone companies be allowed hereafter to issue securities without a certificate from this commission."

The report gives a list of public utilities properties for which tentative reports of physical valuations were submitted or upon which the engineering staff was engaged during the year ended June 30, 1908. Among these plants are the following:

Electric Plants.—Dodgeville, Eau Claire, Hudson—in progress, La Crosse—in progress, Manitowoc—in progress, Marinette.

Combined Gas and Electric Plants.—Ashland, Kenosha—in progress, Madison.

Combined Water, Gas and Electric Plants.—Beloit—in progress, Chippewa Falls, Ripon, Superior.

Combined Electric Railway and Light Properties.—Eau Claire, Menominee.

Taxation of Electrical Companies in Pennsylvania.

It has been uniformly held in Pennsylvania that the real estate of a public or quasi-public corporation, essential to the exercise of its corporate franchises, is not subject to local taxation in the absence of legislative authority imposing such taxes. The power to tax necessarily includes the power to sell for nonpayment of taxes, and thus the property of a public corporation, without which it could not perform its duties to the public, could be sold piecemeal and the corporate purpose be defeated by divesting the title to certain portions of the real estate against which tax liens were filed. Again, many quasi-public corporations extend into and through different municipalities, and as a question of public policy, it has not been deemed wise to subject them to the exactions of the taxing officer at every municipal division line, but rather to authorize the Commonwealth to impose a capital stock tax upon such corporations; and, in appraising the same for the purpose of taxation, the real estate, franchises, earning power, dividends and all other matters which affect the value thereof must be taken into consideration. In this manner the real estate of a quasi-public corporation is taxed, and while the tax goes directly to the State in the first instance, cities, boroughs, townships, school districts and other municipal divisions receive the benefits of such taxation by appropriations made to the public schools, to hospitals, to eleemosynary institutions and to charities of different kinds located throughout the State. The following is quoted from the opinion of the Supreme Court of Pennsylvania accompanying a decision holding that the real estate of the York Haven Electric Power Company is exempt from local taxation:

"The only question in the present case is whether appellee is a quasi-public corporation within the meaning of the law, so as to entitle it to exemption from local taxation. The learned court below so held, and, after careful consideration, we have reached the same conclusion. If companies incorporated to supply water, electricity and light to the public are exempt from local taxation, under the rule hereinbefore mentioned, it is difficult to see why a company incorporated for the express purpose of supplying water and power should occupy a different position. So far as the power of taxation is involved, there is no difference in principle between a company incorporated to supply water or electricity to the public and one incorporated to supply both water and water power which produces electricity for the same purpose. The test in such cases is not what the corporation has done or what it may attempt to do, but what it is authorized to do and may be compelled to do under its charter in the performance of the duties imposed thereby. It does not appear in the application for the charter nor in the letters patent what particular supplemental statutes it claims the benefit of, but it is specifically stated that the corporation is formed 'for the purpose of supplying water and power to the public and to firms, individuals and corporations in the borough of York Haven, York County, Pennsylvania, and the territory adjacent thereto.'" A corporation organized for the purpose of supplying water to the public has been held to be a quasi-public corporation and it has also been decided that a corporation created for the supply, storage and transportation of water and water power for commercial and manufacturing purposes is a quasi-public corporation. It would therefore seem to necessarily follow that a corporation possessing the power to do both of these things is no less a quasi-public corporation. Conoy Township v. York Haven Electric Power Plant, Supreme Court of Pennsylvania, 71, Atl. Rep., 207.

Niagara Falls Illumination.

It may be that the illumination of the Falls of Niagara as a night spectacle will be re-established during the coming summer for the entertainment, instruction and pleasure of the thousands of people who annually visit Niagara. Mayor Anthony C. Douglass has always been a warm advocate and supporter of the electrical illumination, and recently W. D'Arcy Ryan, of the General Electric Company, was at the Falls in conference with the Mayor and other interested citizens relative to making the illumination a night feature of the summer to come. The main obstacle is the raising of a fund large enough to cover the expense, but indications are that the railroads will be disposed to assist the project. It is understood that Mr. Ryan feels he can improve greatly on the spectacle as it was presented in 1907, when the illumination amazed visitors by its beauty.

Edison, Still Inventing, Goes South.

Mr. T. A. Edison has left Orange, N. J., this week for the South, where he will spend some weeks on his plantation at Fort Myers, Fla. When seen at his laboratory just before leaving, he was found busily engaged with half a dozen workmen and experts on some details of his storage battery. Of the present form several thousand are in use, especially in Germany; but Mr. Edison has not been satisfied with it himself. With regard to the improved style now under test, he spoke very emphatically as to its capacity and endurance, and said he proposed to put it on the market at an early date. Meantime he refuses to manufacture any more of the old type, although existing customers continue to send in orders.

Mr. Edison was also found to be actively occupied with the perfection of a new form of telephone transmitter for special service on railroads. During the period of carbon transmitter invention around 1877-8, Mr. Edison made innumerable types and an exhaustive investigation; and he is now resuming some of the work that promised results at that time. After the telephone passed out of his own hands at the time of consolidation, Mr. Edison said, he lost much of his interest in it, and other cares engrossed him in the lighting field. The demand and imperative necessity in the railway field has been urged upon him so strongly of late by many of his friends in the railroad telegraph departments, he has been led to take up the subject again, with most gratifying results. The new transmitter is remarkably sensitive. Mr. Edison notes that even to-day, "Unless something is already known of the speaker or the subject, people frequently have to repeat and repeat or are asked to spell it out, or give it up. With my new transmitter, of the variable pressure type, but with very novel electrodes, I think I compass the entire alphabet with a clearness and sharpness of enunciation never before attained." Mr. Edison said the transmitter would doubtless find extensive use outside the service for which he primarily intends it. Several roads are awaiting the production of these telephones before making extensions of their dispatching systems.

Although under positive medical instruction not to do it, Mr. Edison, prior to his departure South, has been working nightly in his laboratory, finding himself simply incurable where the habit of work is concerned. Otherwise the doctors give him a clean bill.

Hydro-Electric Development in Maine.

At a meeting of the Massachusetts Street Railway Association held in Boston on Feb. 10, Mr. John R. Graham, president of the Bangor Railway & Electric Company, Bangor, Maine, read a paper entitled "The Electrification of a Part of the State of Maine." In the course of his address special consideration was paid to the recent important hydro-electric developments in Maine.

The history of the Bar Harbor & Union River Power Company is typical of the usual course of hydro-electric developments in Maine. The project of combining the water powers in use on the Union River, at Ellsworth, Maine, had been in mind for about 30 years. The originator of the plan finally succeeded in interesting a fellow townsman sufficiently to employ an engineer to investigate the feasibility of the project. The report was favorable, and plans were drawn for the installation. As the Union River is in a somewhate remote portion of the country, had never been mapped by the government and was so little known that the numerous engineers who investigated the project for various capitalists could not be convinced that sufficient power was available, it was difficult to secure the money needed to develop the work. Finally, in 1907, the Bangor Railway & Electric Company interests decided to buy the property. Although the project was condemned by many engineers, it is a fact that during the past year, when water was the lowest on record, the Ellsworth plant was about the only plant in Maine which had an abundant supply of water. With the enlistment of capital the third step was completed, but much remained to be done. Detailed plans were to be drawn, contracts for construction were to be let, property rights to be obtained, highways to be relocated, buildings were to be moved from the area to be flooded, and new bridges had to be erected. Actual construction was begun on March 1, 1907. The first three months were occupied in removing sawmills with their accompanying dams, which had occupied the site of the plant for many years, installing the contractors' plant necessary for the rapid and economical construction of the work, and in blasting out the rock required to be removed from the tailrace and canal. On June 9, 1907, the actual construction of the dam was begun, and the work proceeded so rapidly that on Jan. 1, 1908, the plant was practically completed.

The Ellsworth dam is located between two granite bluffs rising 100 ft. above the bed of the river. The dam is of the Ambursen steel and concrete construction, rising 71 ft. above the river bed, and is probably the highest dam in New England. The power house is built of concrete blocks. At one side of the building is a heavy concrete wall forming one side of a canal, the latter having been blasted out of a solid ledge and serving as a forebay from which the water is drawn through penstocks 8 ft. in diameter, which carry the water to the turbines located 60 ft. below. At intervals of 15 ft. in the interior of the dam, which is hollow, buttresses of concrete were built parallel to the flow of the stream. These buttresses were built A-shaped, being about 100 ft. wide at the base and from 60 ft. to 71 ft. high. They vary from 16 in. in thickuess at the top to 36 in. at the base, and are stiffened by concrete beams reinforced by steel bars placed at right angles to the flow of the stream. These buttresses form the supports of a deck or slab of reinforced concrete extending from buttress to buttress entirely across the stream. The deck ranges from 36 in. in thickness at the bottom to 18 in. near the crest. This is the highest dam of this type that has so far been built, and is to all indications thoroughly satisfactory.

The Bar Harbor company has secured practically the control of the whole river with its water supply. The Union River drains a basin covering 525 sq. miles, included in which is a lake area of 40 sq. miles. The annual rainfall of the region is about 34 in. The average temperature is about 42 deg., and as the amount of evaporation is governed by the temperature, this low average is of great value, leaving as it does a large amount of water for the run-off. It is a fact that at no point except in North China does the isotherm of 42 deg. approach so near the equator. Within two miles of the present power station it is possible to construct another dam, thereby raising the present level of the river at that point by about 15 ft. and forming a reservoir which will impound 5,000,000,000 cu. ft. of water that can be used at the power plant at a head of 60 ft. This arrangement would insure about 10,000 hp continuously.

The present development is for 1500 kw. The power station contains two units; one consists of two S. Morgan Smith turbines rated at 1700 hp and directly connected on a horizontal shaft to a 1000-kw, 2300-volt, three-phase, 60-cycle General Electric alternator; the other consists of two turbines rated at 850 hp, driving a 500-kw generator. The e.m.f. is increased to 33,000 volts for the transmission of energy to Bar Harbor and Bangor. One of the novel features of the work is that the transformers and all of the high-tension apparatus are placed in one of the hollow compartments of the dam, in what would otherwise be wasted space.

Energy is transmitted for operating the trolley cars of Bangor, both in passenger and freight service; street lighting in Bangor, Ellsworth and Bar Harbor, industrial service and pumping water for many communities. At Ellsworth, a town of 5000 inhabitants, the company lights the streets and houses, furnishes energy to several local industries, and owns and operates the local water supply system. The energy for the local service is transmitted at the generator voltage of 2300, the e.m.f. being decreased to 500 volts for the motor service and 105 volts for lighting.

The Bar Harbor transmission line is 21 miles long. Use is made of cedar poles placed partly on the highways and partly on private right of way purchased by the company. The three conductors are placed in the form of an equilateral triangle, with the apex on top of the pole, and the two lower wires near the opposite ends of a cross-arm 7 ft. long, the spacing of the wires being 4 ft. The insulators are of brown porcelain, of the Locke type, having double petticoats; they are carried by steel pins covered with porcelain sleeves to guard against short-circuit from the conductors to the pin.

Use is made of six-strand aluminum wire which, thus far, has been very satisfactory. Aluminum as a conductor, in the company's experience, seems to have taken the place of copper perfectly and has the advantages of lower first cost and considerable decrease in the cost of erection.

It was necessary to cross an arm of the sea, called Mt. Desert Narrows, between Ellsworth and Bar Harbor. These are navigable waters and the government authorities required that the lowest wires should be at a minimum height of 125 ft. above mean tide. This action necessitated the erection of two steel towers 160 ft. high and about 900 ft. apart. These towers are erected on opposite shores, on concrete foundations, and carry three conductors of No. 2-0 hard-drawn copper, strung with a sag of 40 ft. at the center of the span. At the shore ends of the spans, and 400 ft. distant, the wires are dead-ended on steel poles 60 ft. high, these being strongly guyed with galvanized steel cables ¾ in. in diameter. At the Bar Harbor end of the line the e.m.f. is decreased to a value suitable for local lighting and industrial service, a portion of the energy, however, being sent 11 miles farther to light Northeast Harbor, the transmission potential being 10,000 volts.

From the plant at Ellsworth a line similar to that going to Bar Harbor is extended to Veazie, the company's present water-power plant, a distance of 25 miles, where the transmitted energy is used—in times of low water or when anchor ice is giving trouble—to assist in operating the trolley system of Bangor and to carry the Bangor lamp and motor load. At Veazie the company owns a 2500-hp steam plant, and at Bar Harbor one of 1200 hp. These plants are so interconnected that in case of a breakdown at Ellsworth energy can be sent to Ellsworth or Bar Harbor or to Bangor, as needed. The new dam has had no trouble from anchor ice on account of the great depth of the pond.

There are five principal lake chains in Maine connected by rivers and discharging into main channels which deliver into the ocean. These are the Umbagog-Rangeley series, with an

area of about 90 sq. miles, drained by the Androscoggin River; the Moosehead series, forming the headwaters of the Kennebec River; the Penobscot series; the Schoodic Lakes, drained by the St. Croix River, and the headwaters and stream of the St. John River. The topography of Maine tends to equalize the rainfall over the watersheds, and the effect of the heavy forests also tends to equalize the yearly flow of the streams. The lakes are most valuable at times of low river stages, tending to preserve the regularity of flow and to avoid the need of auxiliary steam plants. Though much has been done to control the storage water in the lakes of Maine and thereby increase the dry-weather flow of the streams, co-operative development is most desirable, such as has taken place on the Presumpscott and Cobbosseeconte rivers from artificial storage.

The Penobscot has the largest drainage area of all the rivers in Maine, or about 8500 sq. miles, or more than one-fourth of the State. An area of 800 sq. miles of the river basin discharges its waters into the main river below the lowest water power at Bangor.

Several hydro-electric developments have been made in the Penobscot within 14 miles of Bangor, passing upstream, the river dropping about 88 ft. in that distance. Dams are built across the main channel at five points, using an aggregate fall of from 55 ft. to 60 ft. There are also three dams on Stillwater branch, Stillwater and Orono. At Montague a 20-ft. fall is utilized. At Veazie, on the Penobscot, there are several small falls where the working head varies from 7 ft. to 11 ft. Under the larger head the wheels at present installed furnish 1650 hp, 1500 hp being used for electricity and the balance for pumps to furnish the water supply for the towns of Veazie and Brewer. There is in use a steam plant of the same rating as the turbines, for some steam power is required in the summer. The electricity developed at this station is utilized for street lighting at Brewer, for commercial arc and incandescent lighting in Bangor, and for trolley service in Bangor and to Winterport and Old Town.

The Kennebec River basin extends from the Canada line to the ocean. It is 150 miles long, varying from 50 to 80 miles in width, and embraces a total area of 6330 sq. miles. The general elevation is less than that of the Androscoggin basin. Moosehead Lake, with an area of 120 sq. miles, forms about one-third the entire lake surface in this basin. The sources of the streams forming the Kennebec are at an elevation of from 1800 ft. to 3000 ft. There is a mean descent of about 9.1 ft. per mile throughout the water-power portion of the river.

The seven waterfalls at present utilized are between Carritunk Falls and Augusta and aggregate in rating 24,000 hp; they utilize about 142 ft. of the total fall of 314 ft. between those points. The International Paper Company uses 3500 hp at Carritunk Falls under a head of 30 ft. At Madison during normal stages of the river a head of 20 ft. is utilized, the power being at present about 2250 kw. The larger consumers at Madison are paper companies, textile companies and a local pumping station. The Great Northern Paper Company uses about 1200 hp in electrical service at all times.

Only a small part of the power available at Madison is employed as yet. The Great Northern Paper Company has made plans for utilizing two falls just below the town. One is a 20-ft. fall, to be used exclusively for electrical service. A dam about 640 ft. long will be built and sufficient apparatus will be installed to generate 3000 hp. The other fall will be used mechanically for grinding wood pulp.

At Skowhegan a 17-ft. fall is utilized, giving 5100 hp. About 750 hp is used exclusively for electrical service. Energy is used by grist, saw, planing and woolen mills, sash and blind, and scythe factories. At Augusta, the head of tide water, a crib dam 17 ft. high and 950 ft. long has been constructed, impounding water 17 miles upstream to Waterville. On the east bank of the river the Cushnoc Paper Company and the Kennebec Light & Heat Company use 1500 hp, the latter company furnishing the municipal lighting for Augusta, Gardiner, Hallowell and Togus. The fall is affected somewhat by the tide.

On the Androscoggin River at Brunswick about 1000 hp is used by the Brunswick Electric Light Company for service in Brunswick and Topsham. No lack of water at this privilege has ever been experienced. At Lewiston the large cotton mills and the city employ water power extensively, the rates for the older companies being by lease, from $5 per hp-year to $12.50 for the later comers. These prices apply to the net power on the shaft, assuming the latter to be 75 per cent of the gross power of a given fall and quantity of water. The mills run 60 hours a week, and in some cases daily measurements are made of the power. Auxiliary steam power is somewhat used.

At Deer Rips a dam is being constructed to make available a fall of 28 ft. for electric power in Lewiston. At the Crooked Rips, opposite the town of Turner, there is a dam, built some years ago and giving a moderate fall, but now serving no useful purpose. At Livermore Falls 500 hp is developed for electric lighting and 2500 hp for mill work. The head realized is about 16 ft., but the rapids extending downstream indicate that an additional fall of about 25 ft. is available.

Mr. Graham stated that there are many other water powers in use for both mechanical and electrical service, and quoted others of the former type in conclusion. The electric developments cited were those with which he is in close touch.

Selective Emission of Incandescent Lamps.

A paper entitled, "Selective Emission of Incandescent Lamps As Determined by New Photometric Methods," by Messrs. E. P. Hyde, F. E. Cady and G. W. Middlekauff, was read at a meeting of the New York Section of the Illuminating Engineering Society, held on Jan. 11.

The recent development of high-efficiency metallic filament lamps has aroused new interest in the measurement of the high temperatures of glowing metals, and has raised the question as to whether the high efficiencies are due primarily to the high temperatures at which the filaments operate, or to a selective radiation, where by selective radiation is meant that the distribution of the energy in the spectrum of the radiating body at a given temperature is different from that of a black body at the same temperature.

A recent photometric study by the author of the relative properties of the newer metal, and the older carbon filament lamps has led to the establishment of two new photometric methods by which a positive qualitative criterion may be had of relative selectivity of two radiating filaments. According to the first method if one filament is maintained at some definite voltage or current—that is, at some definite temperature—and the voltage of a second filament is changed until the distribution of energy in the visible spectra of the two as determined by a spectrophotometer is the same, then if the two filaments had identical radiating properties the energy curves of the two would be identical throughout the entire spectrum, and the temperatures of the two filaments would probably be the same. If this were the case, the ratio of the energy in the visible spectrum to the total energy radiated would be the same for the two filaments. Now, the energy per second radiated in the visible spectrum can be measured by determining the lumens, and the total energy per second radiated can be determined by measuring the watts supplied to the lamp since there is no convection and very little conduction.

If the radiating properties of the two filaments were identical, the lumens per watt under the above condition would be the same for the two filaments. Conversely if under the above conditions the lumens per watt are different, one of the filaments must be radiating selectively with respect to the other.

According to the second method the two filaments are brought to the same distribution of energy in the visible spectrum in the same way as that employed in the first method. If now a determination is made for each filament of the percentage change of candle-power in a specific direction—equivalent numerically to percentage change in flux—corresponding to 1 per cent change in watts supplied to the lamp, these two

coefficients of change of candle-power corresponding to 1 per cent change in watts would be the same if the radiating properties of the filaments were identical. Conversely, if the two coefficients are different, one filament must be radiating selectively with respect to the other.

In the actual use of these two methods the determination of the agreement in the visible spectrum of the energy curves of the two filaments had been made, not with a spectrophotometer as described above, but by means of a color match in an ordinary Lumner-Brodhun contrast photometer. If one lamp is maintained at some definite voltage and the voltage of a second lamp is changed until the color of the light radiated by the two lamps is the same, as observed in the photometer, it has been found that the spectrophotometric curves of the two filaments agree excellently. The color-match method is simpler and perhaps even more exact than the spectrophotometric method, provided there is no strong selectivity within the visible spectrum.

By the use of the above two methods it has been shown qualitatively that there is a decided difference in selectivity among different filaments.

It is not possible, however, to determine the exact amount of the difference in selectivity without knowing the true temperatures for the determination of which there is at present no known accurate method.

By making an assumption which has been found to be true for platinum and which, although probably correct for most metals, has not been demonstrated to be true, it is possible to form an idea of the direction in which the difference in temperature will occur and to place a lower limit on the effect of selectivity in partly accounting for the high efficiency of the metallic-filament lamps.

If we imagine a radiating body which tends to exaggerate in its emission the energy of the shorter wave-lengths—that is, a body which emits a larger proportion of its total radiant energy in the visible spectrum as compared with a black body and the same true temperature—it is probable that this property of selective emission would obtain in the visible spectrum also, so that the emission in the blue would be relatively larger than the emission in the red as compared with the emission from the black body at the same temperature. If this assumption, which would seem to be true for platinum, is true for tantalum, tungsten and osmium, then the values recorded in the last column of the tables give, in every case, the lower limit of the effect of the selectivity on the efficiency of the filaments.

TABLE I.—AVERAGE VALUES OBTAINED ON LAMPS OF EACH TYPE AT VOLTAGES CORRESPONDING TO A "COLOR MATCH" WITH THE STANDARD LAMP AT 75 VOLTS.

Types of filament.	Red black-body temperatures.	Relative change in cp for 1 per cent change in watts.	Flux per watt.
Untreated carbon	1,420 C.	1.00	1.00
Helion	1,405	1.00	0.97
Treated carbon	1,395	0.97	1.06
Gem	1,400	0.98	1.05
Tantalum	1,340	0.83	1.28
Tungsten	1,345	0.79	1.49
Osmium	1,390	0.80	1.85

TABLE II.—AVERAGE VALUES OBTAINED ON LAMPS OF EACH TYPE AT VOLTAGES CORRESPONDING TO A "COLOR MATCH" WITH THE STANDARD LAMP AT 100 VOLTS.

Types of filament.	Red black-body temperatures.	Relative change in cp for 1 per cent change in watts.	Flux per watt.
Untreated carbon	1,680 C.	0.86	3.85
Helion	1,650	0.85	3.85
Treated carbon	1,645	0.84	4.15
Gem	1,650	0.84	4.0
Tantalum	1,570	0.72	4.35
Tungsten	1,555	0.71	5.25
Osmium	1,610	0.69	5.9

TABLE III.—AVERAGE VALUES OBTAINED ON LAMPS OF EACH TYPE AT VOLTAGES CORRESPONDING TO A "COLOR MATCH" WITH THE STANDARD LAMP AT 125 VOLTS.

Types of filament.	Red black-body temperatures.	Relative change in cp for 1 per cent change in watts.	Flux per watt.
Untreated carbon	1,890 C.	0.76	9.0
Helion	1,850	0.75	9.2
Treated carbon	1,855	0.74	9.5
Gem	1,855	0.76	9.4
Tantalum	1,765	0.65	10.0
Tungsten	1,740	0.67	11.5
Osmium	1,800	0.65	12.5

The results of an investigation of a number of kinds of filaments using both of the methods are given in Tables I, II and III.

In Table I are given the values found for the lamps when at a color match with a 110-volt 3.5 carbon lamp consuming 3.5 watts per candle, taken as a standard, when operated at 75 volts. In Tables II and III are the corresponding data for the lamps when at a color match with the standard lamp at 100 and 125 volts respectively. The values in columns 3 and 4 are in terms of arbitrary units so taken that for the untreated carbon filament at a color match with the standard lamp at 75 volts, the value in each case is unity.

If there were no selectivity, the lumens per watt would be unity for every type and the coefficient of percentage change in candle-power for 1 per cent change in watts would be the same for each type.

It should be noted that since some of the measurements were made under conditions that were not entirely satisfactory, while the general conclusions are probably quite definitely established, yet the numerical results given in the tables are not insisted on to a high degree of accuracy.

The order of the filaments is that of their relative selectivity, and it is significant that this order is the same by both methods and for the three arbitrary temperatures of the standard lamp at which measurements were made.

The helion filaments which were used were old, and they may have lost the silicon deposit, which fact may account for their position in the table.

In discussing the paper, Mr. J. W. Howell stated that facts indicating the relative selectivity of treated and untreated carbon lamps were discovered many years ago. It was observed that when treated carbon lamps and untreated filaments were operated at conditions which gave equal lives to the filaments, they seemed to be operating at the same temperature as determined by optical methods, although the specific consumption of the treated filaments was much less than that of the untreated filament. That is to say, the more efficient lamp did not appear brighter to the eye, the specific brilliancy of the two being practically equal.

Discussion of Electric Motors.

At the meeting of the American Association of Electric Motor Manufacturers, held in Pittsburgh, on Jan. 26, 27 and 28, 1909, a number of papers were read on subjects of interest to electrical men as well as to makers of motors.

Mr. J. M. Hipple discussed temperature ratings for semi-enclosed and enclosed motors. He stated that a motor experiences an increase of temperature rise of from 12.5 per cent to 25 per cent when changed from the entirely open to the semi-enclosed type. He expressed the opinion that when fibrous coil insulation is used a temperture rise at full-load of 55 deg. C. on the windings and 60 deg. C. on the commutators should not be exceeded in any type of motor. When use is made of non-combustible insulation temperature rises 20 deg. C. higher may be allowed.

Mr. L. E. Underwood, in describing factory tests of direct-current and alternating-current motors, stated that the General Electric Company subjects all of its small motors, excluding fan motors, up to and including 10 hp, to an e.m.f. of 1500 volts when the normal voltage does not exceed 400, and to 2000 volts when the machine is intended for from 400 to 800 volts.

Mr. R. S. Feicht claimed that the temperature rise of semi-enclosed constant-speed induction motors for continuous duty should not exceed 40 deg. C. at full-load, while enclosed motors of the same type, and all induction motors for intermittent duty, should not experience a temperature rise exceeding 55 deg. C. at full-load.

In a paper devoted to starting devices for direct-current and alternating-current motors, Mr. H. D. James made the follow-

ing recommendations for standard starters with constant-speed motors:

Direct-current motor starters should be provided with no-voltage release and should be so arranged that the handle cannot be left in any of the starting positions. A starter for a slip-ring type of induction motor should consist only of the starting device connected in the secondary circuit, and should not be provided with a no-voltage release. The line switch and the overload protective devices should be separate from the starter. Starting devices for squirrel-cage induction motors should not be provided with either overload or no-voltage release attachments. The starting switch should be arranged for use as the line switch.

No Municipal Plant for Lima, Ohio.

After a long controversy, the City Council of Lima, Ohio, has voted to give the contract for street lighting and a franchise for 10 years to the Ohio Electric Railway Company, which already occupies the field. There was active agitation for the establishment of a municipal plant, but the Council evidently considered that with the reduction in price for arc lighting made by the company there was left no incentive for the city to go into the lighting business itself. The new price is to be $57.50 per lamp per year. The old price was $85. The ordinance specifies that within 2½ years the company shall replace its present equipment of street lamps "with metallic flame lamps which shall use electrical energy required by the flow of approximately 4 amp of current under a difference of potential which shall not vary beyond the limits of 66 and 74 volts per lamp at the lamp terminals."

The rates for commercial and domestic lighting are 8½ cents for the first 25 kw-hours consumed per month. For consumption in excess the rates decrease until all over 2400 kw-hours per month is billed at a 3-cent rate. The minimum bill is 50 cents per month. This schedule of rates, while it undoubtedly will be popular with small consumers who use current but a short time each day and who get a rate below the cost of production, is not equitable to small consumers using current many hours per day, as they have to pay the losses on the short-hour consumers. The rates on power are according to the same general plan, being from 7 to 3 cents per kw-hour.

Testing High-Tension Insulators by Means of Polarized Light.

A paper read by Prof. A. S. Richey and Dr. Frederick Bonnet before the Worcester Polytechnic Institute chapter of the Sigma Xi Society described a method of testing high-tension insulators which served to show defects in annealing that could not be detected by other methods. Experience had shown that of two types of insulators made by two different manufacturers so as to be practically identical in form and using glass of the same chemical composition, one gave excellent results in service, while the other was subject to excessive breakage. Tests by means of polarized light proved that the latter type was subjected to stresses caused by improper annealing, while in the former there was an almost entire absence of stresses.

In carrying out the tests each insulator was so mounted that when it was rotated about its pin axis the same thickness of glass skirt was always presented between the polarizer and the analyzer, which previously had been arranged so as to allow no light to pass. Stresses in the insulator were indicated by the varying intensity of light and by color changes. The insulators showing stresses had been poorly annealed. Under service conditions they became heated on account of conductive leakage and were destroyed.

The authors expressed the opinion that the polarized-light method is valuable in detecting poor insulators, although the tests can be considered as only qualitative.

Chicago Electric Club.

The Electric Club of Chicago held its first annual election Feb. 3 at its regular weekly noonday luncheon. Two tickets were presented, one the regular ticket of the nominating committee and the other an independent ticket. The former ticket prevailed, the officers elected being as follows: President, Mr. C. A. S. Howlett; vice-president, Mr. Frederic P. Vose; secretary, Mr. William S. Taussig, Marquette Building; treasurer, Mr. James G. Pomeroy. Board of Managers: Messrs. W. R. Pinckard, Henry F. Holland, John J. Schayer, F. S. Hickok and S. F. Dibble.

At the meeting of the club on Feb. 10, Mr. W. S. Taussig, the new secretary, announced the names of the new chairmen of committees as follows:

Speakers: Mr. F. S. Hickok, of the Ridgway Dynamo & Engine Company. Finance: Mr. S. F. Dibble, General Electric Company. Entertainment: Mr. John J. Schayer, Commonwealth Edison Company. Membership: Mr. H. F. Holland, Pacific Electric Heating Company. The House and Reception: Mr. W. R. Pinckard, Westinghouse Electric & Manufacturing Company. The membership of the club is now so large that the present weekly luncheon quarters at the Automobile Club are hardly large enough for all to attend. Therefore, it is possible that there may be a lull in the campaign for new members, which has been very successful, until arrangements are made to secure permanent quarters.

The speaker of the occasion was Mr. Frank L. Perry, who had for the sumbject of his talk, "The Wright Aeroplane and Its Possible Adaptation to Wireless Telegraphy." Mr. Perry, who witnessed the recent demonstrations of the Wright aeroplane at Ft. Myers, near Washington, is a great admirer of the beautiful mechanical means adopted to make the flying machine a success. He set up before those present a small model of the aeroplane which he had made, and explained its various parts and their operation. He then made a demonstration to show how the machine might be used in sending and receiving messages by "wireless," using two aerial wires, one to serve the usual purpose of a "ground." The whole demonstration and the informal talk accompanying it were very interesting to the members, and Mr. Perry was highly complimented.

CURRENT NEWS AND NOTES.

ELECTROLYTIC RECTIFIER PATENTS.—United States patents to the number of 45 have been issued to date on electrolytic rectifiers.

PATENT COURT.—The Judiciary Committee of the House of Representatives has reported favorably the American Bar Association bill providing a court for the trial of patent suits. The bill establishes a court of five members to sit in Washington, the chief justice to be appointed by the President and the four associate justices to be designated from among the judges of the Circuit and District Federal Courts by the Chief Justice of the Supreme Court of the United States. Two of the associate judges will sit for three years and the other two for six years, after which they may be redesignated for six years.

OHIO INDEPENDENT TELEPHONES.—According to statistics prepared by President Frank L. Beam, of the Ohio Independent Telephone Association, the number of Independent stations is now 324,663, as against 307,674 in 1907. Thirteen new exchanges have been established within a year, and the number of toll stations has increased from 1690 to 1895. The number of stockholders has also grown from 25,458 to 30,961. In the past three years the number of subscribers to Independent service has increased from 196,000, showing a gain of 128,000. According to this report, the Bell companies have 300 exchanges, 848 toll stations and 172,225 stations in the State.

TELEPHONES IN NEW YORK CITY BUILDINGS.—The five largest office buildings of New York City contain 2360 miles of telephone wire and almost 10,000 telephones.

CARNEGIE INSTITUTE WORK.—The current year-book of the Carnegie Institution shows that during the past year $636,300 was distributed among nearly 500 persons engaged in conducting scientific research. Plans have been completed for a specially designed ship, to be called the *Carnegie,* which will be built in Brooklyn and used for magnetic surveys in the Atlantic Ocean.

MICHIGAN ELECTRICAL ASSOCIATION.—Mr. A. C. Marshall, of Port Huron, Mich., secretary of the Michigan Electrical Association, has just issued in bound form the proceedings of the fifth annual convention of the association, held last August. The papers and discussions have been well edited, and the volume is a credit to the enterprising electric light association which issues it.

ELECTRICITY AT THE PANAMA CANAL LOCKS.—It is stated that the Board of Engineers which accompanied President-elect Taft on his recent visit of inspection to the Isthmus of Panama will recommend that some sort of electrical apparatus be employed for stopping ships before entering the canal locks and also for towing them into the locks. The object of this is to avoid damage to the lock gates by collision.

WIRELESS TELEGRAPH BILL REPORTED.—The Committee on Merchant Marine and Fisheries, which has been considering the wireless telegraph bill, reported it favorably to the House last week. The bill, as finally drawn, provides a penalty of $300 fine or one year's imprisonment, or both, for the failure of any ocean-going craft, carrying more than 50 passengers and going 200 miles, to have on board a wireless outfit and an operator. The bill does not apply to the Great Lakes, but there will be a fight in the House to include this shipping.

MAXIM SILENCERS.—The demonstration by Mr. H. P. Maxim of his gun silencer last week, in New York City, briefly noted in these pages, continues to excite great interest in the various arts and crafts affected. With regard to the weight of the device, it is so small that no appreciable burden is added to the rifle; and it is carried in any pocket until the moment of use, when it is screwed to the muzzle in a second. The weight of the smallest silencer is only 5¾ ounces, while that of the largest is 11 ounces, all made of steel. Some controversy has arisen over the humanitarian aspects of the invention, in its possible liability to abuse by vicious individuals.

GERMAN TELEPHONE RATES.—Much indignation is felt in Germany against a measure now before the Reichstag which, it is claimed, will largely increase telephone rates. The bill proposes to abolish the present system whereby Berlin subscribers got practically an unlimited service for the lump sum of $43.20 a year, substituting an annual rental charge of $24 for telephones with an additional fee of 1 cent for every connection made. The bill affects all Germany, but its provisions would be felt especially in Berlin, where it is computed that the result would be the raising of the average annual cost of business telephones to $72 or $96, or even in the case of some firms to $144.

THE CHAMBERLAIN LIBRARY.—The first section of the valuable library of the late Mr. J. Chester Chamberlain, who during his life was prominent in electrical circles, was sold by the Anderson Auction Company, 12 East Forty-sixth Street, New York City, on Feb. 16 and 17. This section comprised only first editions relating solely to 10 American authors: Longfellow, Bryant, Lowell, Whittier, Thoreau, Poe, Emerson, Hawthorne, Irving and Holmes. The total number of items was 882, including numerous dedication copies. Nearly all of the books are cased in covers (the original binding being preserved) designed by the owner and made by Bradstreet. The remaining portion of Mr. Chamberlain's library will be sold later.

INSTITUTE ANNIVERSARY DINNER.—The Dinner Committee of the American Institute of Electrical Engineers, to arrange for an anniversary banquet, celebrating the first quarter of a century of the society, which was founded in 1884, held a meeting last week at which it was decided to hold the affair at the Hotel Astor, New York City, on March 11. The price of the dinner, for which an excellent menu has been provided, is $5, including one wine, cigars and cigarettes. As usual on these occasions, ladies will participate, and an attendance of at least five or six hundred is expected. There will be only a few speeches, and these will be given by men of national prominence. Special attention is being paid to decorations, music and the souvenir menu. The following are the names and chairmen of the special committees: Speakers and Menu, T. C. Martin; Reception, M. Coster; Finance, G. A. Hamilton; Tickets and Seating, R. T. Lozier; Decorations, A. Williams; Press and Music, G. H. Guy; Old Timers, E. A. Sperry.

PARIS CONTROL OF CITY TRANSPORTATION.—The control of urban transportation is the subject of a measure now before the Paris Council which, it is stated, will be accepted by traction companies if enacted. Its main features are a division of profits between the traction companies and the city, and provision for municipal purchase of all railways at the end of specified periods. The companies will pay 4 per cent to the city on their gross earnings, after 8 per cent net profits have been distributed to the holders of stock. The remaining profits are to be divided equally between the companies and the city. Should the Council not exercise its right to purchase at the end of 10 years it may do so at any time thereafter, but at the expiration of 35 years the entire system, including conveyances, plants and everything pertaining to the ownership and operation of its lines, falls into the public's hands. None except Frenchmen shall be allowed on the administrative boards of the companies during the concession. Moreover, all materials used must be French in origin or manufacture, except in cases where especially authorized by the prefect of the Department of the Seine.

BUDAPEST NEWS-TELEPHONE.—According to a consular report, the Budapest news-telephone service, established many years ago, continues in successful operation. An annual subscription, $7.31, paid quarterly in advance, entitles the subscriber to two receivers and the full service of news, music, etc., the subscriber to pay the expenses of installation and removal, generally about $8.50. The service begins at 8:55 a. m., when a buzzing noise, loud enough to be heard across a large room and lasting 15 seconds, announces the correct time. At 9:30 the day's program of important events is announced; that is to say, the ceremonies, lectures, plays, races, etc. At 10 and 11 o'clock stock quotations and general news items are given. At noon comes a second announcement of the correct time, followed by parliamentary news and general items of interest. At 12:45 stock quotations from local, Vienna and Berlin exchanges and general news are given. At 2 o'clock more parliamentary and general news, and at 3 p. m. the closing prices of stocks, meteorological forecast, local personals and small items, and in winter the condition of the various skating places. At 4 p. m. court and miscellaneous news. From 4:30 to 6:30 military music from one of the great cafés or gardens. In the evening the subscriber may choose between the royal opera or one of the theaters, and later music by one of the tzigane orchestras. This program is sufficiently varied to satisfy the desires of all classes of subscribers, and in general the service seems to give the utmost satisfaction.

Transformer Substation for Niagara Energy at Rochester, N. Y.

ALTHOUGH the Rochester Railway & Light Company possesses a miniature Niagara in the Genesee River, the latter stream has not the Great Lakes back of it, to insure constancy of supply. For this reason steam-driven units are kept in readiness at all times, and having developed the water power to its economical limit, the question of carrying the ever-increasing railway and lighting load was only answerable in two ways: Either the company had to install more

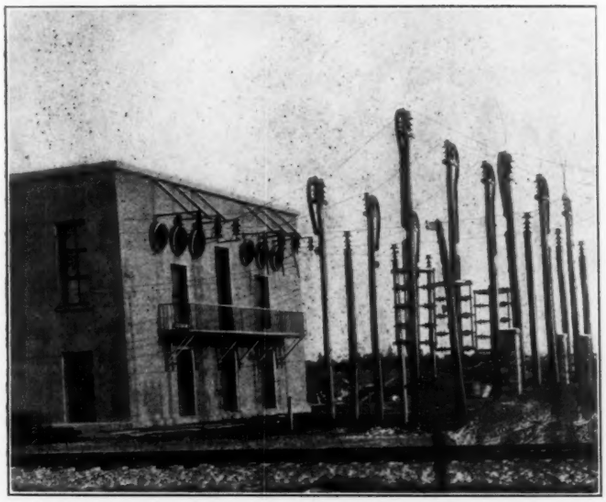


FIG. 1.—INCOMING LINES AT SUBSTATION.

steam-driven units or it would have to connect up to the Niagara transmission lines, passing outside of Rochester, on their way to Syracuse and the intervening towns. After careful consideration the company found it expedient to contract with the Niagara, Lockport & Ontario Power Company to take an initial load of 4000 hp. In order to receive the energy and to transform it to pressures appropriate for its distribution circuits, the Rochester Railway & Light Company erected a transformer substation adjacent to the Lehigh Valley Railroad tracks at the corner of Elmwood Avenue. While the plant is now in complete operating condition, it has not yet been developed to its ultimate capacity, which will probably not be reached for several years. The building and essential operative apparatus have been designed and built to accommodate an ultimate load of 24,000 hp, but at the present time working apparatus for 4000 hp only has been installed.

The energy is delivered by the Niagara, Lockport & Ontario Power Company to the Rochester Railway & Light Company at the former's switching station at Mortimer, N. Y., at which point also energy is delivered to the Erie Railroad and from which it is also sent on to Syracuse. Up to Rochester steel towers 55 ft. high carry the cables and from there to Syracuse wooden A-shaped frames are used. The insulators weigh about 75 lb. and have two petticoats and a hood, the latter having a diameter of about 14 in. The steel towers are set 550 ft. apart, and the A-frames are placed 220 ft. apart. From Mortimer the energy is brought over two separate transmission lines to the substation referred to, which is known as Station No. 33. The Niagara, Lockport & Ontario Company's switching station is located about four miles outside the city and 40-ft. to 50-ft. steel towers and aluminum cables run on a private right-of-way adjacent to the Lehigh Valley Railroad tracks, between both stations.

The transmission line carries 60,000-volt, three-phase, 25-cycle current and before entering the transformer station the lines pass through protective apparatus carried on some 40 wooden poles, as shown in Fig. 1. These poles contain three series of horn lightning arresters with air-gaps and resistance. The shortest path consists of a carborundum resistance; the next consists of a concrete column and the longest path comprises about 15 ft. of thin copper wire acting as a fuse. The lightning arresters are of a type specially designed for use on the Niagara, Lockport & Ontario system and the theory on which these arresters are installed is that for ordinary slight static disturbances in the line, the arrester having the lower striking e.m.f. will discharge, and since it has in series with it a comparatively high resistance, the resultant disturbance due to the current which follows the discharge will be comparatively slight.

A more severe static disturbance causes the lightning arrester having the lowest gap and the arrester having the next higher gap to discharge simultaneously, thus affording two paths to earth, the combined resistance and inductance of which is much lower than that of the first path. When both arresters discharge the disturbing effect on the system, due to the generated current which follows, is much severer than that in the first instance. For a direct lightning stroke on the line, the three arresters would discharge simultaneously; the long, thin copper wire in the case of the arrester with the highest air-gap blowing and interrupting the arc upon it, the disturbance of the circuit finally ending upon the other two arresters.

The substation building is approximately 50 ft. wide, 120 ft. long and 30 ft. high. It is built of reinforced concrete, the walls being 16 in. thick and having an 8-in. space in the middle formed by the use terra-cotta tile. The roof is made of tile laid on steel rafters and purlins, which are left bare underneath the tiling. The window frames are of metal with self-closing sashes in case of fire and wire-mesh glass. In the construction of the building electricity was used for every conceivable purpose, including the mixing and hoisting of concrete, the pumping of water, the cutting of pipe and even the cooking of lunches for the foreman. The building is divided into three

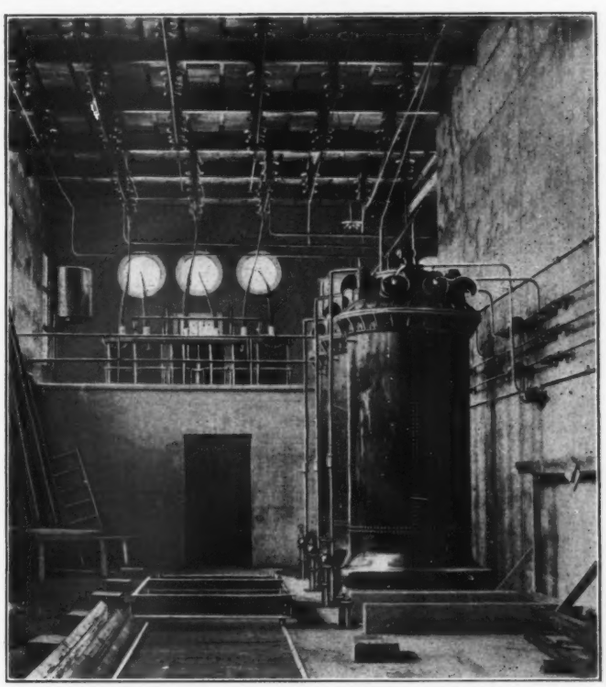


FIG. 2.—TRANSFORMER ROOM, SHOWING ALSO HIGH-TENSION BUS CONSTRUCTION ON CEILING.

parts; a two-story inlet room at the south end, a transformer room on the east side extending from the floor to the roof, and a two-story distributing room on the left side. The latter consists of an operating room on the second floor and an entrance and bus room on the lower floor. The lower part of the inlet room is used for water circulating pumps, a storage battery, bathroom and storeroom. On the upper floor are two Westinghouse oil circuit-breakers. Each of the two sets of three

lines pass to these from the lightning arresters, entering the building through six bull's-eyes made of 36-in. sewer crocks, each closed with a double window of glass, through which passes a large porcelain tube. The circuit-breakers are equipped with inverse time relays.

After leaving the circuit-breakers, the conductors are carried on insulators suspended from the roof rafters over the transformer room, as shown in Fig. 2. The conductors form a loop here and are so arranged that any part of the ring bus can be isolated from any other part for repairs, alterations or additions. Practically all the conductors inside the building are bare copper or aluminum pipes. From the bus, the circuit is carried to transformers which step down the voltage from 60,000 to 11,000, the pressure at which it is delivered into the city. At present four 1000-kw, oil-and-water-cooled transformers are installed, one of which is kept in reserve for emergency use. Fig. 2 shows a view of the transformer room, which is large enough to contain ultimately 18 of these transformers. In this room there is a pipe trench 3½ ft. deep and about 3 ft. wide extending down the center and normally covered with steel floor plates. On either side of the trench is a standard rail, the two forming a track for a small transfer car by means of which the transformers may be run to the north end of the room, which is partitioned off from the main room and which is provided with a 16-ton hand hoist. This arrangement was considered preferable to the use of a traveling crane as though slightly less convenient, the infrequency of use makes this inconvenience tolerable, as against the larger cost of a traveling crane and the obstruction that the latter would have introduced in suspending the conductors from the roof. In the pipe trench are four main pipes, a cold-water pipe, a warm-water pipe, a clean oil pipe and a foul oil pipe. The circulating water is pumped from the Genesee River to a well inside the station building, whence it is repumped through the transformer coils and discharged to the river or run over a riffle board of concrete, where the water is exposed in a thin sheet to the atmosphere and to slight evaporation. The use of the riffle board saves the continuous lift of water from the river, 1500 ft. away.

In the operating room on the second floor is a tank capable of holding enough oil to fill one transformer case. A similar tank is set into the ground floor of the inlet room, and in case it becomes necessary to repurify the oil in any transformer, a reserve supply carried in the foul oil tank is pumped through the oil dryer and filter to the clean oil tank on the second floor. A valve on the transformer is then opened and the foul oil

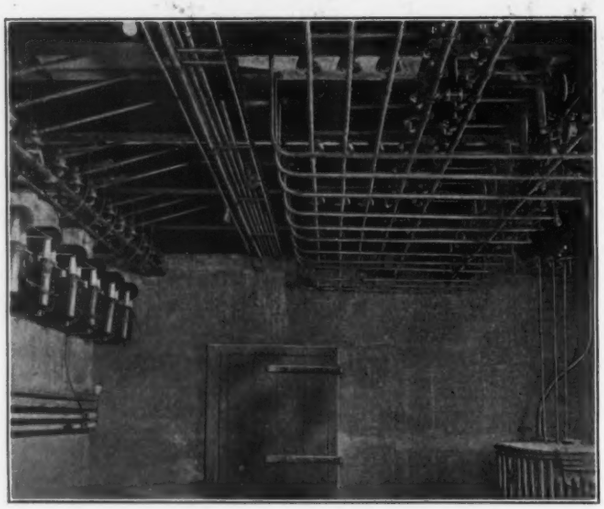


FIG. 3.—BUSBARS UNDER 11,000-VOLT SWITCHES.

flows by gravity to the submerged tank. The foul oil valve is then closed and the clean oil valve opened, whence the transformer case is rapidly filled from the elevated storage tank. The foul oil can then be dried and filtered in a leisurely manner by means of a Westinghouse outfit for dehydrating the oil.

After leaving the transformers the energy at reduced pressure is delivered to the bus room on the first floor on the west side of the building, passing upward and downward to and from oil circuit-breakers located on the operating floor above, until it is finally delivered to the underground cables connecting the transformer substation with Station No. 6. The connections in the bus room are so arranged that energy can be delivered from any set of transformers to any outgoing feeder without interfering with the general scheme of operation. Aside from the switchboard and clean oil storage tank there is nothing on the operating floor except the 11,000-volt oil switches. For operating the switches when the ordinary circuit provided for that purpose is not alive a battery of 66 cells, charged for a mercury rectifier set, is installed. The building is heated electrically and for the circuits in the station, two three-phase transformers are installed; each rated at 40 kw.

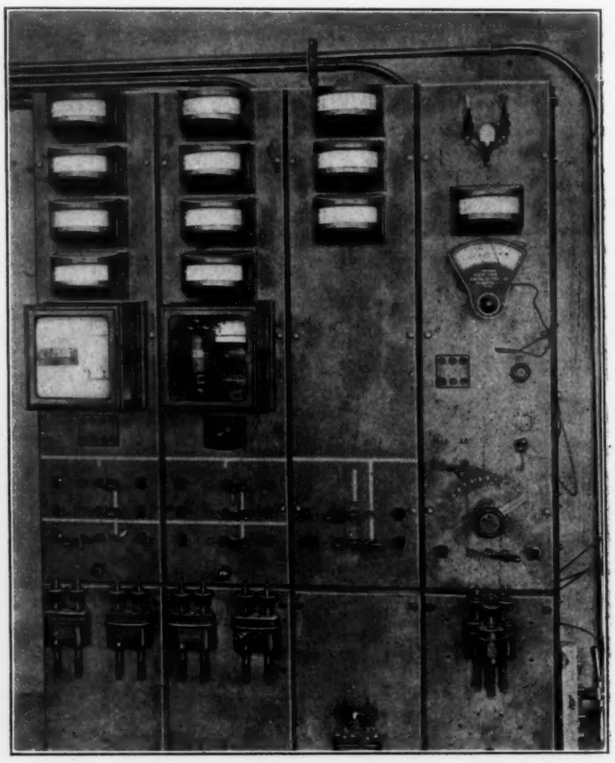


FIG. 4.—FRONT OF SWITCHBOARD.

In the entrance room a 1000-kw, three-phase, 25-cycle transformer is installed. This steps up the voltage from 11,000 to 18,000 for transmission over a wooden pole line 27 miles long to Canandaigua, where a motor-generator set is installed for carrying the railway load of the Rochester & Eastern Rapid Railway. Aluminum wire is used on this transmission circuit.

It is a significant fact that the engineers of the Rochester Railway & Light Company should regard the large investment necessary for the transformer station building with some misgivings. Located as the station is, adjacent to a public park, it was of course necessary to house the apparatus in a suitable structure; but had the station been located at some other point it is certain that the engineers would have seriously considered placing all the high-tension apparatus out of doors and make suitable provision for the switchboard and switchboard attendants only. There can be no doubt but that with a trifling expenditure, high-tension apparatus can be placed out doors without detriment to the apparatus or to its reliable operation. Although the scheme contemplated would have been slightly in advance of modern practice, the trend is in the direction indicated and away from expensive structures which serve no useful purpose, add to the fixed charges and oftentimes are inimical to reliable and continuous operation.

Power Plant Extensions of the Boston Elevated Railway Company.

AUTHORITATIVE information has been obtained concerning the enlargement of the power plants of the Boston Elevated Railway Company. This work was carried out and completed about a year ago by the Stone & Webster Engineering Corporation, but for various reasons the details have not been available until the present time. In December, 1906, the engineers were called upon by the Boston Elevated Company to study the power situation of the elevated and surface lines of Boston. Investigation showed that 7500 kw in additional electrical equipment was needed immediately and that the shortage would in the course of another year increase to more than 10,000 kw. It was, therefore, decided to install without delay 10,800 kw of direct-current generating machinery with the necessary boilers, while an ultimate decision on recommendations for a plan of broad permanent power development was pending. On Jan. 18, 1907, definite arrangements were made for the work of construction.

The emergency installation of 10,800 kw consists of four 2700-kw units distributed among three power stations. Two of the units were added to the Lincoln Wharf station, located on the harbor front in the heart of Boston proper, and one each to the Harvard station in Cambridge, and the Charlestown station, on the Mystic River, in Charlestown. It was stipulated that these new installations should be ready for service within one year, or by Feb. 1, 1908. At the same time still earlier completion was desired in order that the equipment might relieve the old stations before the next succeeding period of heavy winter traffic and the work was pushed with this end in view.

The stations were maintained in regular operation throughout the period of enlargement. Some serious physical difficulties interfered with rapid work. The construction was of a heavy and permanent character, and was at no point compromised for the urgent time requirement. Notwithstanding these various adverse circumstances the desired time was made. The work was finished within 10 months, so that the various units were ready to go under commercial load.

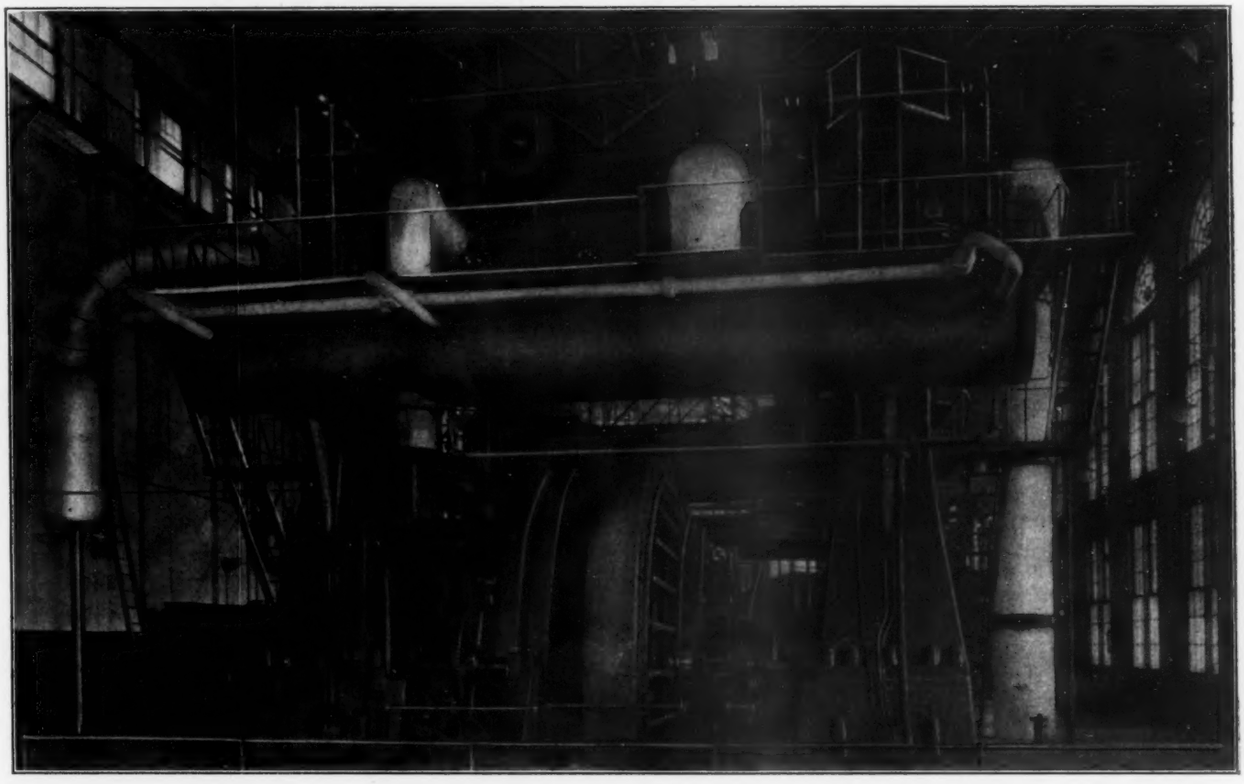


FIG. 1.—VIEW OF INTERIOR OF CHARLESTOWN STATION.

LINCOLN WHARF STATION.

The Lincoln Wharf power station furnishes electrical energy for the surface and subway lines in the heart of the city, as well as for a large part of the elevated system. The original station contained three 2700-kw, direct-current, vertical, cross-compound units and 6000 hp of Babcock & Wilcox boilers. The extension for the two new units is carried on a heavy concrete foundation supported on piles. The superstructure frame is of very heavy steel, particularly in the boiler room, where it is designed to carry boilers, economizers and an overhead bunker of 3000 tons capacity, or 33 tons per linear foot. Both the foundations and superstructure were designed by the constructing engineers, the architectural features being worked out by the architectural department of the Boston Elevated Company.

The new boiler room equipment consists of eight 600-hp Babcock & Wilcox boilers, with boiler suspensions attached directly to the building columns. The superheaters have such area that they will give 50 deg. superheat at normal boiler output and not more than 75 deg. at 50 per cent normal output. Roney mechanical stokers, each having an effective grate area of 111 sq. ft., exclusive of the dead plates and one-half the dumping grates, are provided throughout. The grates proper are of the sectional-fin type. The boiler feed-water equipment consists of four Warren outside, center-packed pumps in the basement under the boilers, any three of the pumps being of sufficient capacity to supply all the boilers when running at 50 per cent overload.

The feed water passes successively through primary heaters between the engines and condensers, through open heaters fed by exhaust steam from the auxiliaries and finally through the economizers. These economizers are of the B. F. Sturtevant heavy pattern, tested to 400-lb. cold-water pressure. The primary heaters between the engines and condensers are of the

horizontal, closed type and are designed to raise the feed water from 40 deg. Fahr. to within 5 deg. of the temperature of the exhaust steam. The open heater is of the Cochrane horizontal, cylindrical type, with cast-iron trays, and raises the temperature of the feed water to within 3 deg. of the temperature of

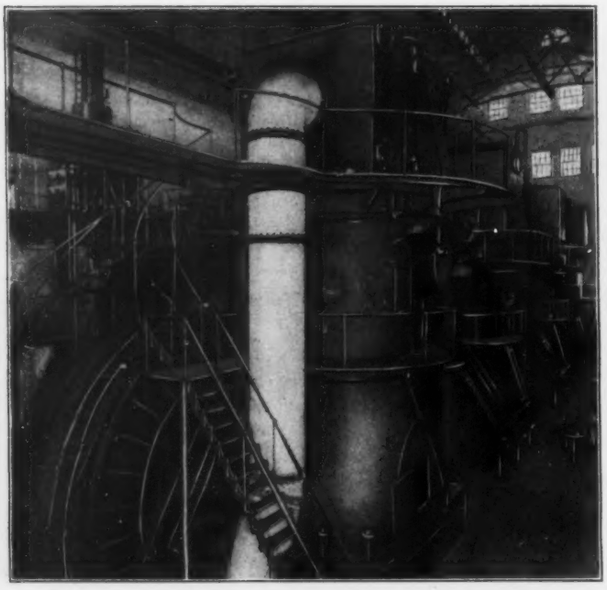


FIG. 2.—INTERIOR OF LINCOLN WHARF STATION.

the exhaust from the auxiliaries. The result is that the economizers deliver the water to the boilers at a temperature of about 250 deg. Fahr.

Squire's automatic feed-water regulators have been supplied in all the stations on old boilers, as well as new. This device controls the feed valve through pressure exerted on a diaphragm which tends to close the valve when the water in the boiler rises above a predetermined level. A pilot valve actuated by the expansion of a metal harp located in the side of the boiler regulates the pressure on the diaphragm. The harp is placed at the proper height in respect to the water level to give the maximum expansion or contraction for any change in the height of the water. The action of this automatic device is safeguarded by a water-column alarm which will attract the fireman's attention and enable him to regulate the water supply by a hand-operated valve in case of disarrangement of the automatic feed.

The new engines are of a heavy rolling-mill type, with a large factor of safety, and were built by the William Tod Com-

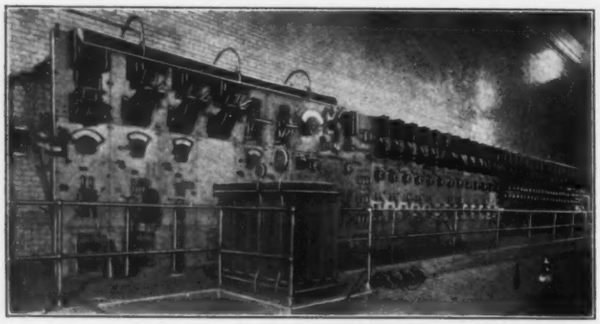


FIG. 3.—SWITCHBOARD, LINCOLN WHARF STATION.

pany. When running at the designed initial steam pressure of 180 lb. per square inch, they have a sustained overload capacity of 50 per cent, with decrease in normal speed not exceeding 2 per cent. Each engine has a special barring arrangement consisting of a circular rack inside the rim of the flywheel and a pinion driven by a 30-hp electric motor. Jet condensers, built by the Warren Steam Pump Company, are used in connection with vertical, direct-acting, twin air pumps. The steam cylinders are 16 in. and the air cylinders 48 in. in diameter, with a common stroke of 24 in. These condensers were at the time

FIG. 4.—BOILER ROOM, CHARLESTOWN STATION.

of installation the largest of the type that had been turned out by the manufacturers.

The generators are of the direct-current railway type and were built by the Allis-Chalmers Company. The winding is compound and designed so that by the adjustment of a shunt on the series field they will operate at any characteristic between an approximate rise of 10 per cent and an approximate fall of 10 per cent, at the full-load potential of 575 volts. The falling characteristic was required to provide for proper distribution of load among the company's various stations. Commercial efficiencies guaranteed by the makers ranged from 89 per cent at one-quarter load to 94.8 per cent at full-load, decreasing to 94 per cent at 50 per cent overload. The switchboards and electrical distributing system have no particularly novel features. However, a part of the reconstruction consisted in moving the switchboard proper from a level of the engine-room floor to a gallery extending the entire length of the engine room.

In the general work of construction one of the more difficult features was a new tunnel for the supply of condensing water.

FIG. 5.—BOILER ROOM, HARVARD STATION.

Previously the plant had been supplied through a suction main, but the enlarged station required a gravity intake and limited space made tunneling necessary. The tunnel is 6 ft. in diameter and 210 ft. long, lying 19 ft. below mean high water. It was driven without the use of a shield in 56 working days and

without the slightest accident. The workmen were safeguarded from danger of cave-in by steel roof plates.

CHARLESTOWN STATION.

The Charlestown station furnishes electricity for all the lines operating in Charlestown, Somerville, Everett and Chelsea. The old station contained 1200 hp of engines, boilers and auxiliaries in a small structure, and one 2700-kw unit, with boilers, in a modern extension of the original structure, making practically 4000 kw in all. The recent work consisted in the enlargement of this newer portion to accommodate the new unit and to provide space for a future machine of the same capacity. It included also the construction of intake and overflow tunnels for the condensing requirements of both old and new portions of the plant. The original suction intake and overflow pipes were so deteriorated as to require replacing, in any event, so they were entirely done away with and a new gravity system was installed. The intake and discharge tunnels are about 800 ft. long and 4 ft. in diameter, leading to the Mystic River.

In the new building, the foundations are of concrete with wide footings resting directly on a bed of hard gravel, except under the new chimney and a portion of the north wall, where, on account of an underlying stratum of silt, it was necessary to drive piles. The superstructure is of steel frame and brick construction with a longitudinal brick wall dividing the engine room from the boiler room. The new boiler room will accommodate eight 600-hp Babcock & Wilcox boilers, though but four such boilers are included in the present installation. The new chimney and flues are of sufficient area for eight boilers. The boilers were built according to exceptionally rigid specifications, no cast iron or semi-steel being permitted in any part of the work. They were erected entirely independent of the building structure. In front they are carried on building columns, and in the rear by the standard Babcock & Wilcox type of suspension.

Superheaters are included and are of the same type and heating capacity as those installed in the Lincoln Wharf station. The new stoker equipment also is similar to that in the Lincoln Wharf station. The overhead bunker capacity is 600 tons, or 75 tons per boiler. This is three days' supply, or enough to carry over holiday periods or periods necessary in which to make repairs on coal-handling or conveying apparatus. The conveying apparatus consists of an inclined bucket conveyor from a hopper outside the building to the top of the boiler room and a horizontal fly conveyor to the several bunkers.

Economizers were not installed, because that would have entailed increasing the area of the boiler room and the saving effected by them would not have justified the extra expense. To heat the feed water, both a primary heater between engine and condenser and a Cochrane open heater are installed. The primary heater raises the temperature of the water to within 5 deg. of the temperature of the exhaust steam from the engine. The open heaters then increase the temperature of the feed water to about 210 deg. Fahr. before it enters the feed pumps.

The new engine is of the vertical cross-compound type and was built by McIntosh, Seymour & Company. The normal rated capacity at 190 r.p.m. and 160-lb. steam pressure at the throttle is 4100 hp, the maximum capacity being 7000 hp. With a superheat of 50 deg., the guaranteed steam consumption varies from 12.75 lb. at one-quarter load to 12.5 lb. at full load, increasing to 13.85 lb. at 50 per cent overload. The valve gear is the standard type of the makers, the main steam and exhaust valves being driven by fixed eccentrics, while the steam cut-off is effected by a riding valve controlled by a shaft governor. All valves are of the gridiron type. The condensing apparatus is similar to that in the Lincoln Wharf station.

The new generator in this plant is of the General Electric 600-volt railway type. It is built with commutating interpoles and was one of the first large generators thus equipped. In this case the operation has been most effective. Sudden and extreme changes of load can be effected without shifting of the brushes, and, even when running at a 50 per cent overload, the circuit-breaker may be tripped without sparking at

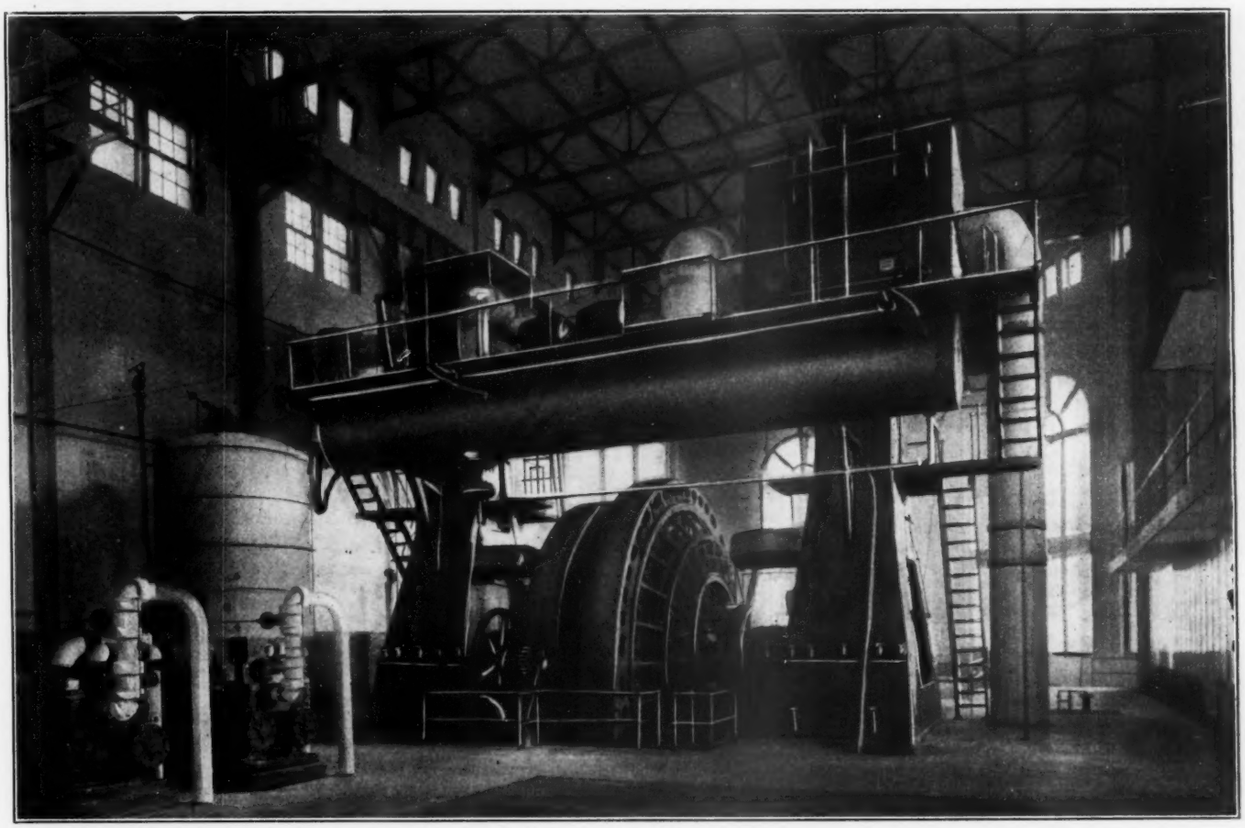


FIG. 6.—VIEW OF INTERIOR OF HARVARD STATION.

the brushes. At the same time the generator has run satisfactorily in parallel with the other generators of standard non-interpole type. The guaranteed commercial efficiency of this interpole generator varies from 94 per cent at one-half load to 95½ per cent anywhere in the range from full load to 50 per cent overload.

Aside from the actual extension, a great deal of reconstruction was carried out in the old plant with a view of increasing efficiency and reducing fire risk. New stokers were placed under four of the old boilers. Old motor-driven feed pumps were replaced by duplex steam pumps. The piping system was changed over, and a Bulkley condenser was replaced by a twin vertical air pump and jet condenser, the same type as the condenser installed with the new engine. The switchboard was relocated in a steel and concrete gallery. A fireproof floor was built in the engine room, replacing a wooden floor, and various changes were made in the oil filtering and distributing system.

HARVARD STATION.

Located on the new Charles River Boulevard, near Harvard Square, this station serves Cambridge, as well as the rapidly growing districts to the north and west. In this station more than in either of the others has a revolution been worked in the external appearance. Architecturally, it has been very carefully designed so as to conform to a park-like environment. The old structure was a plain brick building containing 3600 hp of engines and boilers. The new extension fronts on the Charles River Boulevard and its pleasing façade practically effaces the older portion.

In building this station unusual measures were adopted to secure stable foundations. The ground is of a swampy nature and in the old station the horizontal engines caused marked oscillations of the structure, especially when any of them got to working in unison. To obviate this weakness a plan was used in the new structure which practically made a monolith of the entire foundation bed. The whole foundation area was first enclosed in a cofferdam of heavy yellow-pine sheet piling driven to a depth of 30 ft. below grade. Piles were then driven within this area until it was literally packed solid. Whereas the first piles driven sank into the silt almost 20 ft. under the mere weight of the hammer, the piles last driven finally encountered such friction that the travel was only about 1 ft. under the blow of a 2000-lb. hammer. This elaborate sub-base was completed and the concrete foundation laid upon it ready for the steel within two months from the time ground was broken.

The old and new portions of the foundations were bonded together by means of steel beams and rods buried in the concrete and the steadying effect of the new sub-base is transmitted to the old foundations through this bond. While the remote end of the old building still vibrates, the motion gradually diminishes to the point of junction with the new structure, beyond which point there is no perceptible movement.

Severe restrictions were encountered by the engineers in planning the discharge water system. The Park Commission of the city of Cambridge had permitted the building of the plant on the chosen site only upon the agreement of the Boston Elevated Campany to prevent the oil in the condensing water from finding its way into the Charles River. Filtration was not practicable owing to lack of room for filters large enough to handle the 800,000 gal. of water discharged per hour at peak load. The labor required to keep such filters in order presented another objection. The device finally decided upon was virtually a large separator. The discharge water flows slowly through a concrete pit of large area. The oil rises to the surface before the end of the pit is reached and is held by means of baffle boards until it can be drawn off into the oil pit. The oil pit is formed at one side of the separator by an adjustable weir. In practice, it has been found that this weir can be adjusted so the flow over its top at peak load will be just sufficient to remove the oil which has accumulated at lighter loads, thus making the separation process nearly automatic. The slight amount of water which comes over into the oil pit is drawn off by means of a drain connected to the city sewer. There has been no trouble from oil getting into the river. In this station the equipment does not differ in any noteworthy particular from that installed in the Charlestown station, and detailed description is unnecessary.

Electric Annealing Furnaces for Hardening and Tempering High-class Tools.

By John B. C. Kershaw.

THE present writer in an article which appeared in the *Electrical World* of April 25, 1908, discussed the application of the electric furnace in the iron and brass foundry and showed that although electricity at present is the most expensive heating agent, it can in many cases be applied in the iron and brass foundry with advantage. It is interesting to note that electric furnaces are now replacing crucibles, cupolas and other forms of melting furnace in many of the European steel works, and that the change from coke or gas-fired crucibles and furnaces to electric furnaces is said to be allied with improved metal and increased economy. An example of this kind is that of the Bonner Fraser Fabrik, at Bonn, Germany, where a large Stessano electric furnace has replaced a battery of crucibles for the preparation of the metal required in light castings.

The arguments for the use of electric heating for the furnaces used in the tempering and hardening of tools are even more convincing than in the case of foundry practice, for in this case the cost of the heating agent is of little importance in comparison with the value of the finished product. It is, therefore, unnecessary to repeat the cost data which were given in the earlier article. The other advantages of electric heating are, however, of much greater value in the case now presented. The cleanliness of operation and the ease with which any temperature between the limits of 500 deg. C. and 1400 deg. C. can be obtained and maintained for any length of time are two of the most important advantages of electric heating, while the possibility of excluding the air from the chamber containing the articles and of carrying on the work in some non-oxidizing gas is a minor advantage, which in some cases would alone decide the question of the relative merits of the two systems of heating. It is not contended that the method is suitable for large pieces of work—such as armor plates and gun casements, which are now face-hardened by special heat treatment—but for tempering, hardening and annealing the smaller pieces of work there is no doubt whatever that the use of electricity as the heating agent offers great advantages, and that in time electric annealing and hardening furnaces will be found in all up-to-date works, manufacturing knives, scissors, springs and similar articles.

Three types of furnace are at present in use for this particular class of work. All of them are of the resistor type, since the heat produced by the electric arc is too high and too variable to be successfully employed for this purpose. In furnaces of the first type, platinum gauze or foil is employed as the resistor medium, long strips of narrow foil or gauze being wound spirally round the tube crucible or muffle which is to contain the articles requiring heat treatment. In the second type of furnace, a patented resistor material known under the trade name of "Kryptol" is employed, capped cartridges filled with this material being used as the heating units, and arranged round or in the walls of the containing chamber or vessel. Finally, there are furnaces in which a bath of fused metallic salts is employed for heating the articles, this bath being kept in the molten state by means of electric current. It is important in this case that alternating current alone should be employed, otherwise electrolytic action may occur and the metal salt may be decomposed into its elements.

With each of the three types of furnaces it is necessary to employ some accurate form of pyrometer for measuring the temperature of the furnace. One of the recording forms of these is

most suitable, since the personal attendance required is then reduced to a minimum. The regulation of the temperature is of course, obtained by varying the strength or intensity of the current, and other conditions being the same. A reliable wire or tube resistor frame or a small water rheostat will therefore be a necessary adjunct of the electric annealing furnace for obtaining the necessary variation in the current strength.

Examples of the three types of furnace will now be described and illustrated.

1. *Platinum Resistor Furnaces.*—The electric current can be employed for temperatures up to 1500 deg. C., with platinum as the resistor material, but the earlier method of constructing these furnaces, by winding thin platinum wire upon a porcelain tube, was found unsatisfactory, and tube furnaces of this type are now made with platinum foil. The experimental work carried out by Heraeus has proved that foil 0.007 mm in thickness, weighing 1.5 grains per square decimeter, is the most suitable for this purpose. This foil is employed in long, narrow strips and is wound upon the tube so that only 2 mm or 3 mm of uncovered space remains between each coil of the spiral. The contact between the platinum spiral and the tube is thus rendered very intimate, and the temperature of the foil is only a little higher than that of the porcelain upon which it rests; whereas with platinum wire the difference in temperature is often extremely large. A further advantage is that the weight of platinum required is reduced to one-sixth. A tube furnace of this type with a tube 25 mm in diameter can be heated up to 1400 deg. C. in five minutes. This method of construction, however, can be employed only for round vessels, and for other shapes, such as muffle furnaces, Heraeus makes use of fine platinum gauze, which is firmly fixed in or upon the wall of the furnace by a glaze. The spirals of platinum gauze can in this way be embedded in the dome and back wall of a muffle, and uniform heating can be obtained without any risk of fracture. By use of a non-conducting covering, such as an enclosed air space, the radiation losses with this type of furnace can also be reduced to a minimum and electricity at 6 cents per kw-hour can be made equivalent in heating value to gas at 3 cents per cubic meter, while the temperature range is 200 deg. C. higher. Fig. 1 shows a muffle furnace of this type (made by Heraeus) with the resistor box enclosed in the base, the range of temperature of this furnace and resistance being from 700 deg. C. to 1200 deg. C. The furnace is provided with a gold wire safety device which prevents overheating of the platinum wire gauze spirals; and it can be constructed for all e.m.fs. up to 250 volts. At 110 volts a 5-amp current will produce a temperature of 800 deg. C.

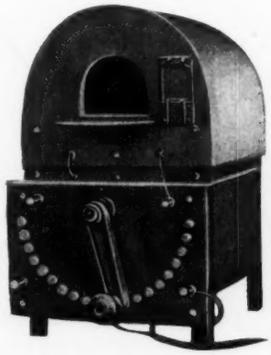


FIG. 1.—PLATINUM WIRE RESISTOR FURNACE.

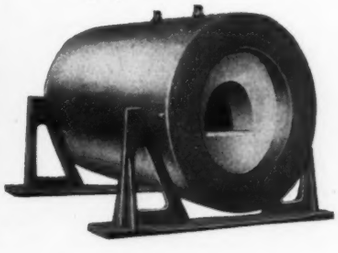


FIG. 2.—PLATINUM WIRE RESISTOR FURNACE.

and 10 amp 1200 deg. C.; while on a 220-volt circuit 2½ amp and 5 amp produce the same temperatures. Fig. 2 shows a similar muffle furnace made by Cook, of Manchester. This furnace has a 4-in. flat bottom and at 1200 deg. C. consumes 1 lb. Fahr. units per hour.

2. *Kryptol Furnaces.*—"Kryptol" is a patented resistor material, of graphite, coke and carborundum, the chief feature of the mixture being that all of the grains are of uniform size, and that they possess rounded corners and edges. There are 30 varieties of the kryptol mixture manufactured, the largest having grains 7 mm in diameter; the relative proportion of the three components are varied to suit the e.m.f. of the energy supply. The addition of graphite increases the electrical conductivity of the mass, while that of coke and carborundum diminishes it. Two classes of heating apparatus are manufactured with this resistor material. In one class the kryptol is employed without enclosure, and thus comes into contact

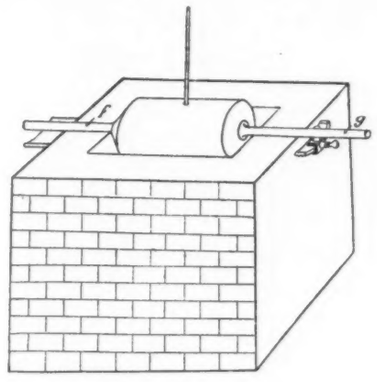


FIG. 3.—KRYPTOL RESISTOR FURNACE.

with the air and with the vessel or articles being heated; in the other class the kryptol is enclosed in air-tight glass tubes with metal caps. The latter method of employing the material has many points in its favor—the kryptol is protected from the action of the air and the temperature is more easily controlled and regulated. The tubes or cartridges of kryptol (from 15 mm to 20 mm in diameter and from 200 mm to 500 mm in length) are held by spring clamps in a specially designed frame, and are connected in parallel to the energy supply leads, such a frame holding 20 cartridges, and being suited for use with either direct or alternating current at 110 volts or 220 volts. The temperatures attainable with these cartridges are necessarily limited, however, by the glass covering (glass melting at 1200 deg. C.) and for temperatures above 800 deg. C. the kryptol must be used in the unprotected state. Fig. 3 shows a furnace of this kind designed by Schoop, and Fig. 4 a muffle furnace manufactured by the Kryptol Gesellschaft, of Berlin. In Schoop's furnace, the kryptol is placed

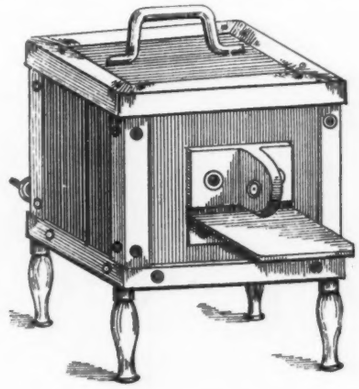


FIG. 4.—KRYPTOL RESISTOR FURNACE.

loosely in the cavity which holds the actual heating cylinder and the energy connections are made by coppered carbon electrodes, embedded in the brickwork at each end of the cavity. The cylinder which rests upon the kryptol is provided with open tubes running parallel with its axis at each end; use is made of a thermometer or pyrometer for controlling the temperature. This form of furnace was used by Schoop for experiments upon the roasting of ores in various gases, but

with the use of some device for protecting against loss of heat, and the addition of a charging opening, it could be employed for hardening and tempering work. It must be noted, however, that when kryptol is employed in this way for the production of high temperatures, slow combustion of the material with evolution of carbonic oxide gas always occurs, and this type of furnace must therefore be provided with a draft-hood for leading away the noxious gases. The muffle furnace, shown

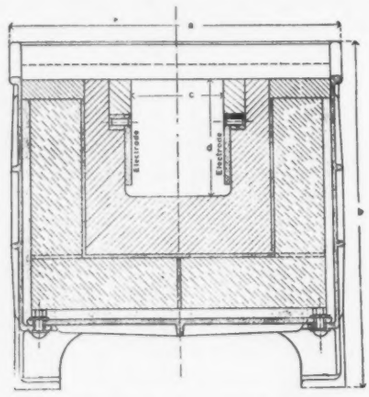


FIG. 5.—FUSED SALT RESISTOR FURNACE.

in Fig. 4, on the other hand, is free from this disadvantage, as the kryptol is here enclosed. The writer has no data showing the temperatures attainable with, or the energy consumption of, these furnaces, but for low temperature work they are no doubt convenient and economical.

3. *The Fused Metallic Salts Hardening Furnace.*—The use of baths of fused metals, such as lead or of fused metallic salts for hardening purposes, is not new in the steel-tool industry, and the only novel feature of the bath about to be described is the employment of electric current for keeping the bath in the molten condition. With gas-heated or coke-heated baths of this kind it is very difficult to keep the whole mass of molten metal or salt at one temperature, and the heating being external the containing vessel is quickly eaten through. By means of electric heating with terminal electrodes of large superficial area, the temperature of the bath can be kept uniform and all danger of unequal heating of the steel can be avoided; moreover, as a result of the method of construction, the life of the containing vessel is indefinitely prolonged. Fig. 5 shows a sectional elevation of such an

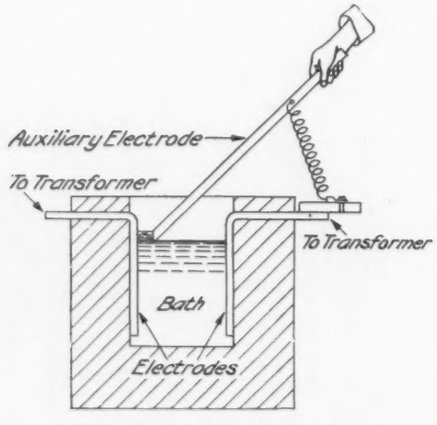


FIG. 6.—FUSED SALT RESISTOR FURNACE.

electrically heated metallic salt bath. A cast-iron containing vessel is first lined thickly with fire-clay, and is then bedded with fire-clay bricks. The cavity is next lined with asbestos, and in this is placed the vessel made without joints for holding the fused salt, the whole forming a compact mass as shown in the illustration. The choice of material for the crucible depends upon the salts used; a well-baked refractory clay is the most suitable. Two sheets of soft iron, which form the electrodes, are supported by the crucible walls, the connection with the main leads being made by transverse bars of rolled iron, placed one upon each side of the crucible cavity. Use is made of a transformer which will yield energy at e.m.fs. ranging from 5 volts up to 55 volts, the latter voltage being required when starting up the bath with all cold. For this purpose an iron rod is placed between the two electrodes, and the connection between this rod and the latter is made by small pieces of arc-lamp carbon electrodes. The secondary circuit, formed in this way, gradually melts the metallic salts lying around the carbon pieces, and in time, by manipulation of the iron rod, the whole upper surface of the bath is molten and forms a conductor. The secondary electrode is then removed and the heating effect of the current carried by the upper layer of molten salt is found to extend gradually until the whole of the bath is melted, and a uniform temperature—which varies with the current strength—is attained. To some extent, the limits of temperature are governed by the composition of the bath, and by choice of certain salt mixtures a fairly high temperature can be had. It is important in the case of this type of furnace to employ only alternating current for the reasons already named.

Fig. 6 shows a furnace of this type made by the General Electric Company, Schenectady, N. Y. In this case a mixture of potassium and barium chloride is employed as the material for the fused bath, and a range of temperature between the limits of 250 deg. C. and 1350 deg. C. is said to be obtainable.

Inductance Coils Used in Wireless Telegraphy.

By John L. Hogan, Jr.

One of the most interesting developments of wireless apparatus is that of the inductances used in both the sending and the receiving circuits. Over 11 companies build instruments which are used in the United States for radio-communication, and all of the systems depend for selective transmission upon adjusting the sending and the receiving apparatus to wave frequency by varying the constants of their oscillating circuits. The actual connections for the elements of the circuits differ considerably, but the methods of tuning are almost identical and in every case involve the use of variable capacities, self-inductances or mutual inductances. The convenient adjustable condenser is coming into wide use, but until recently it has been neglected, for very nearly all the companies utilized fixed capacities and depended upon variable inductances to change the electrical periods of their circuits. This long use of the coils has brought forth a large number of designs for inductances, and many of these are very ingenious.

The condenser used in a transmitting circuit usually has a fixed capacity, so that any change in emitted wave length must be made by changing the amount of inductance in circuit. Since, however, a commercial wireless station rarely transmits more than one length of wave—intentionally, that is—the methods of varying the contact on the coils, and the coils themselves, are rather crude. Sending helices are, in almost every case, roughly, 18 in. in diameter, and contain from 5 to 10 turns of nickeled copper tubing about 3/8 in. in diameter. Coils of this general type, with spring clips for cutting in or out parts of the tubing, have satisfied the designers of nearly all the systems now in use. The only noteworthy variations are the Shoemaker helix of metallic ribbon and the old Fessenden coils made from several strands of rather small copper wire in parallel, though the "scare" spiral of one of the commercial companies is of some interest as an indication of the condition of the wireless telegraph field. This inductance, wound in a plane spiral of about 20 in. final radius, from the usual copper tubing, was made in fear of an anticipated injunction prohibiting the use of the single-diameter coil.

Transmitting through inductive coupling is not very much

used in the United States, and this has naturally delayed the construction of novel oscillation transformers. In Europe highly ingenious methods of operation, involving mutual inductance, have been brought forward; the directive system of Bellini and Tosi is perhaps a worthy example. In America the greatest advance so far disclosed is the simultaneous use of a number of simple air-core transformers. The neglect of loose coupling shows itself in the fact that no known home inventor has produced an exceptional oscillation transformer for wireless telegraph senders. The few couplings in use are merely pairs of simple cylindrical helices, often so mounted that their relative positions, and hence their coefficients of coupling, are fixed.

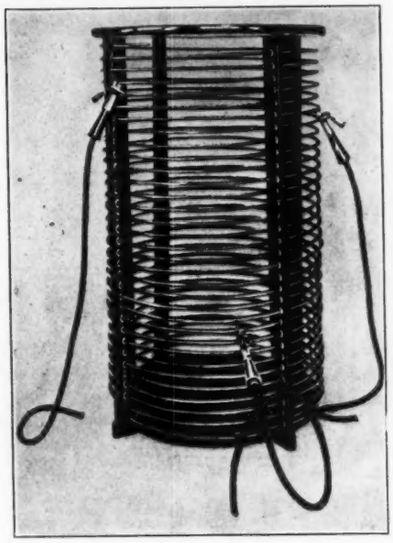


FIG. 1.—INDUCTANCE FOR HIGH-POWER SENDER.

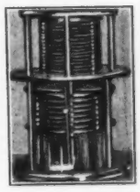


FIG. 2.—SENDING OSCILLATION TRANSFORMER.

When, however, receiving apparatus is considered it is found that much originality has been shown by the designers in their efforts to devise inductances which are different from those in common use. These deviations from the standard types are often improvements, but sometimes are not. Receivers and receiving circuits have nearly everywhere been given more attention than they deserve, proportionally, and as a result there are many forms of low-voltage variable inductance coils.

Some six or seven companies use cylindrical helices of insulated copper wire, wound on wood or fiber in a single close layer, and having one or two sliding contacts which make connection at any desired points on a bare end-to-end path. These coils vary in length only from 10 in. to 14 in. or so, but the diameters run from 1.5 in. to eight times that, according to the amount of wire required on a single core. The sliding contact coils are useful because they are fairly compact and very easy to make. However, to get much inductance with low resistance, and still keep the helices of moderate length, the diameters must be increased; this means loss of close adjustment, since the turn-to-turn steps grow large rapidly. So, therefore, great disadvantages of this type are the impossibility of making small variations in the inductance—with reasonably short coils of considerable inductive value—and the existence of a sliding contact, because of its irregularly changing, and often high, resistance. The first of these points is constantly making itself felt more strongly, and a number of workers have endeavored, more or less effectively, to overcome it. Massie has made an odd form of coil, in which the wire is wound on a block of rectangular cross-section and the resulting oblong turn affair so bent that its former longitudinal axis becomes a long arc of a circle about 8 in. in diameter. The contacts are placed on levers which revolve as radii about the center of this circle. This tuner has not the nuisance of contacts running on rods, but the element of uncertain resistance is still there.

FIG. 3.—STANDARD TYPE OF SLIDING CONTACT HELIX.

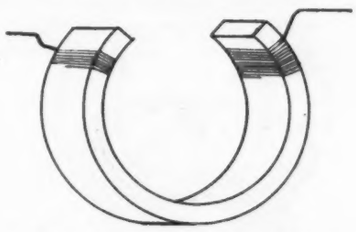


FIG. 4.—BENT RECTANGULAR-TURN HELIX FOR MASSIE'S TUNER.

The necessity for close variation has been met by Dr. Fleming with a coil of bare wire, wound on a grooved wooden cylinder and so arranged that the entire winding may be rotated about its axis. A spring contact presses against it at any desired point, and so both the number of whole turns and the fraction of a turn in circuit between the spring and an end of the helix may be changed. Shoemaker, in this country, has manufactured a similar apparatus for his outfits. The coil will give a very close adjustment between two points in a circuit, but few modern methods of syntony can use a coil having only one variable contact. If a second spring is added to this rotatable helix it is clear that, while small changes in the length of wire between either contact and either terminal of the coil may be made, the length between the springs must vary in jumps of entire turns.

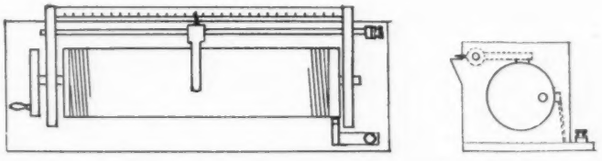


FIG. 5.—FLEMING'S INDUCTANCE STANDARD.

Fessenden used for some time standard roller inductances, in which bare wire was reeled from a metal to an insulating cylinder in any desired amounts. This gave close adjustment, since the wire on the apparatus could be divided in any ratio between the metal reel, where it was short-circuited, and the insulating carrier where it was effective inductively. The only defects seem to be that it is impossible to make large changes of inductance rapidly, and that, if either the wire or the metal cylinder becomes covered with an oxide, microphonic contacts are likely to appear. This latter difficulty has been overcome very ingeniously, for the machines are now so arranged that the wire is always insulated from both reels; this arrangement eliminates poor contacts and makes the resistance uniform. The inductance of the constant length of wire varies with the amount

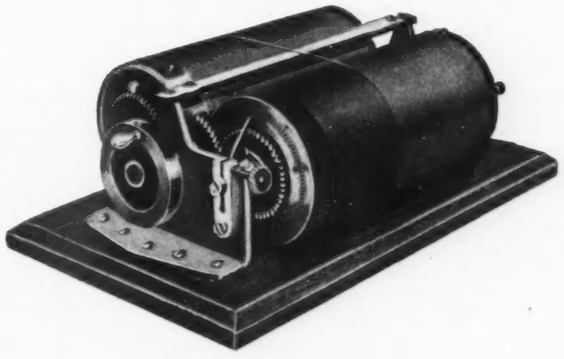


FIG. 6.—INDUCTANCE COIL AS USED BY FESSENDEN.

on either spool, because one carrier is made to act as a short-circuited secondary to a primary formed by the wire it supports, while the other reel—either an insulating substance or a metal cylinder with a longitudinal slit in its surface—allows the wire coiled about it to take its normal inductance. However, even with the new type, large changes of inductance are difficult to make rapidly. Also the question of loss of energy in the short-circuited secondary arises.

A variable coil consisting of a spiral spring whose length of

FIG. 7.—AYRTON-PERRY TYPE OF VARIABLE INDUCTANCE.

extension might be varied was suggested by the writer and used some years ago, but it was found that Dr. Fleming had tried such a helix previously. This method gives an opportunity of making very small changes of inductance, with fixed resistance, since as the turns of the spring approach each other the inductance of the coil increases. The range of a moderate-sized spring is not large, but series coils variable in larger steps make it possible to get any value.

Another form of inductance which the writer has brought forward for use in wireless telegraphy, and which has been independently adopted by a European scientist, is that involving the principle of the Ayrton-Perry standard. It is possible to construct small coils which allow a considerable variation and still have low resistance. This apparatus, which changes the sum of the effective inductances of two windings in series by varying the mutual inductance between them, would seem to be as nearly an ideal for syntonic communication as has been proposed. It may be made compact, there are no points of variable resistance and the change in inductive value is absolutely continuous, and may readily be made to cover wide limits.

In reading the criticisms regarding close and even variation it should be remembered that they are made on inductance coils simply as inductance coils, and not as elements of oscillating circuits. In these circuits there are many cases where inductance may be changed in large steps, and small differences in the

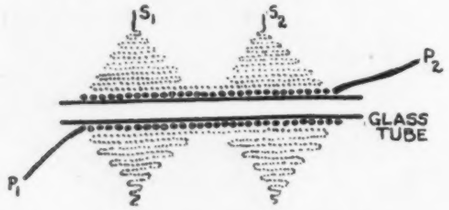


FIG. 8.—DIAGRAM OF SECTION OF MARCONI'S "JIGGER."

period of the system may be made by the use of delicately adjustable condensers; however, these instances do not prove the turn-to-turn helices to be of good design.

There now remain to be considered oscillation transformers used where inductive coupling at the receiving apparatus is preferred. These have been brought out in a number of forms, of which one of the most interesting is Marconi's "jigger." This appliance has gone through a number of changes in its development, but the one aim throughout seems to have been to build a pair of coils of high mutual inductance, yet having low electrostatic capacity between primary and secondary. Marconi wound the secondaries of his transformers in camel-back like humps, sometimes divided into two sections connected by small condensers. These "jiggers," used about 1900, are reported to have increased coherer efficiencies—when compared to direct antenna-to-ground connection—but just how much the uneven windings helped matters would be hard to determine. The problem was to apply the voltage-operated coherer at a loop of potential in

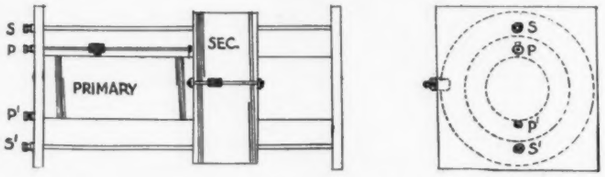


FIG. 9.—SIMPLE OSCILLATING TRANSFORMER.

the antenna system; since the foot of an aerial vibrating at its fundamental is an antinode of current and a node of voltage, some form of transformer seemed necessary. Whether Marconi's "jigger," designed after much painstaking labor, would be more effective than a properly adjusted simple two-helix air-core arrangement is not known.

The simplest inductive coupling in use at present is that consisting of two independent cylindrical coils, each of variable self-inductance, and often so mounted that their relative positions, and, therefore, their mutual inductance, may be changed. In some cases the primary and secondary are concentric, sometimes they are placed with ends abutting, again they are built side by side. In almost every instance the method of connection is that shown in Fig. 10. Tuners of this kind have found some little favor, perhaps because of the many claims of extreme selectivity made for them, and so one finds the expected number of slightly differing designs of the apparatus.

A departure from the usual transformer has a primary wound in a flat spiral on a stiff insulating plate, and a similar secondary, each being fitted with a sliding contact on a lever arm. The coils are mounted with their faces parallel and so arranged that the distance between them can be varied. Since the primary and secondary may be brought close together a very high value of mutual inductance may be had; this, together with the ease of adjustment of the coupling, is the only marked advantage the type possesses. The transformer action is somewhat veiled by a considerable condenser effect between the primary and the secondary, and sliding contacts add to the uncertainty of the device. Perhaps the worst feature of the apparatus is that the turn-to-turn variation is not constant;

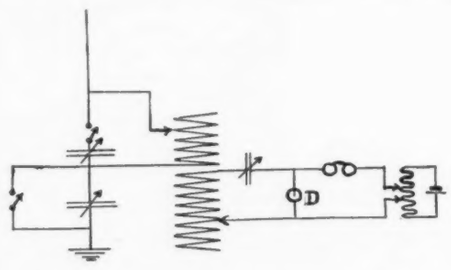


FIG. 10.—STANDARD CONNECTIONS OF LOOSE COUPLED RECEIVER.

clearly the disconnection of a single turn near the outer end of the spiral will cause a change of inductance many times that brought about by cutting out a turn near the center, since the length of the turns increases very nearly in proportion to the radius. This "pancake" coupling was probably first applied to wireless by Ducretet, in 1903 or before (United States patent application filed August, 1903). A patent on an identical apparatus, using two primaries opposing each other's effects on a secondary placed between them, was granted in 1907 to an Ameri-

can exponent of radiotelephony; in practice, however, he seldom uses the secondary primary.

The short-circuited secondary roller type of coil described above has been modeled by Fessenden into a transformer by placing two complete self-inductances end to end. This form of coupling is perhaps as nearly perfect as any so far produced since there is no opportunity for uneven resistance variation, because the self-inductance of either primary or secondary may be changed very minutely, and as the mutual inductance between

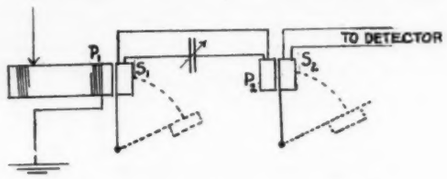


FIG. 11.—DIAGRAM OF STONE'S COUPLINGS.

the coils is adjustable; nevertheless a bad point is that it is impossible to obtain high values of this mutual action.

In all of the above couplings mutual inductance is varied by a translation of one or both coils. To get a very weak inductive effect it is sometimes necessary to separate primary and secondary quite widely. In order to save space by doing away with bulky sliding appliances, Stone has constructed his small transformers with one coil fixed and the other, which is mounted at the end of a short lever arm, arranged to swing through a 90-deg. arc. By building the windings in a semi-pancake form it is possible to get high mutual inductance when their faces are close together and parallel, yet when the fields of the coils are placed in quadrature there is no energy transferred; therefore this type gives a very complete range of coupling coefficients and still is not cumbersome.

In reviewing the designs of self-inductance coils and oscillation transformers only a few really worthy of use are found. Sliding-contact helices of the usual form are valueless for accurate work, not alone because of the uncertain and frequently excessive resistance but because the slider is always likely to be found shunting one or more turns of the coil. This is of the greatest importance, since that part of the helix adjacent to the short-circuited section will have an inductance very different from normal, and the rapid change as the contact piece touches, say, first one turn and then two, will be enough to upset the most careful calculations. Moreover, it is probable that the shunted turn absorbs a considerable amount of wave-energy and so prevents a maximum effect on the detecting apparatus.

It would seem, therefore, that the inductances of the future, or at least those used in wireless communication, will have no loose contacts. The exact type of coil to be finally adopted depends absolutely upon the method of syntonization ultimately accepted as thoroughly satisfactory.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

A Free Iron Proposition at Marion, Ind.

The Marion (Ind.) Light & Heating Company has been increasing its number of residence consumers with the aid of a special proposition which seems to be taking well. The company advertised extensively through the newspapers and by means of its talking sign in front of its office, that it would give a free electric iron to any consumer wiring his house within 30 days. This time limit was later extended. In six weeks 140 new residence consumers were secured in this way, and all but one of these were on existing lines of the company, so that no extensions were required.

Improvements in Wabash (Ind.) Central Station.

The Wabash (Ind.) Water & Light Company, under the management of Mr. T. W. McNamee, is making this year some very important changes in its electric generating and waterworks pumping plant. Heretofore the company has had steam engines operating separately three different kinds of service, namely, 125-cycle alternating-current service, 500-volt direct-current service for power purposes and independent steam-driven water pumps to supply the waterworks system. As the old plant was being outgrown and the necessity of more economical power generation in order to secure power business became evident, it was decided to replace the engine equipment entirely with steam turbine units and to generate all current at 2300 volts, 60 cycles.

The pumps in this plant will be operated by electric motors, and the old 500-volt, direct-current power circuit will be taken care of by a motor-generator set. This will put the company in a position to reach out and compete more actively for the large power business in the town, and to carry its entire pumping and electric load on one fairly well loaded turbine unit. There are to be installed two turbines, each one capable of carrying the entire present load on the station.

The Boston Edison Company and the Electric Vehicle Business.

BY L. D. GIBBS.

Pioneer or missionary work is ordinarily very edifying spiritually, but the profits are not likely to be materially large. Sometimes, however, the Biblical promise about the return of bread cast upon the waters proves true, even with a central station. This has certainly been the case with the Boston Edison Company, whose pioneer work in the automobile field is now being rewarded to a marked extent.

The advent of the electric vehicle found this company keen to its possibilities, and the management gave its thought and energy, as well as large sums of money, in the work of educating the public to a proper appreciation of these vehicles. The work was taken up on a large scale in 1903. Charging sets were installed on the company's lines at convenient points, and all lighting companies, private and municipal, in New England were asked to furnish information as to the charging facilities. A booklet was issued giving the locations of such charging sets, both upon the company's lines and elsewhere, and this information included the names of stations, individuals, livery stables and garages—all points where charging sets were available for travelers in electric machines. This very complete booklet included also the rates for electricity for charging purposes.

Signs of an especially attractive design were placed in front of all charging stations in the Boston Edison territory, and other signs were fixed at cross-roads and along the highways pointing the direction and indicating the distances to the nearest charging stations. The Boston company distributed these throughout New England at its own expense.

A year later, Jan. 1, 1904, another booklet brought the information up to date, and included the names of all users of electric vehicles in Massachusetts. Still another booklet followed, entitled "Personally Conducted Tours," in which an interesting account was given of a trip made in an electric vehicle owned by the Edison Company from Boston to New York and return. A map was shown of the route and locations of all charging stations and the distances between them.

At that time the company was publishing its monthly bulletin, *Edison Light*, and the August, 1903, number was devoted exclusively to electric vehicles. It was finely illustrated with cuts of the company's machines, showing various practical applications; and there were many illustrations of vehicles then on the market. On the back cover page was a map of the territory from Lawrence and Lowell on the north to the Rhode Island line on the south, and west of Boston to South Framingham, showing the best routes for travel and the locations of all charging stations. That was real pioneer work.

The reward has been tangible for some time now. The electric vehicle has come into its own. These machines have been so greatly improved in efficiency and adaptability to all sorts of service, either commercial or pleasure, that those, around Boston at least, who are not "speed-mad" consider their availability seriously when making purchases. The Boston company has always been a consistent and large user of electric machines. Two trucks of 5 tons and 3 tons capacity, respectively, handle freight and transfer supplies from one station to another. The 3-ton truck is particularly adapted to the requirements of the department of maintenance of lines. Every sort of material is hauled from the company's suburban and city stations to points where improvements and line extensions are being made. A geared winch, located under the driver's seat, proves efficient for handling underground cable and for raising and lowering poles in the suburban territory.

One emergency wagon of 1000-lb. capacity is much used on the underground cable system. It is equipped with a variety of pulleys and cables, and with a crew of men, specially assigned, is ready for hurry-up calls day or night the year round. Another 1000-lb. wagon is used in the department of installations for distributing lamps and meters. It is in almost constant service six days a week throughout the year, covering an extensive territory. A third 1000-lb. wagon is fitted with pumps for removing water from manholes and junction boxes. The pumps on this wagon, as well as the winch upon the truck previously mentioned, are motor-driven from the storage batteries. The company also maintains a number of electric vehicles of the runabout type for the convenience of its officials.

At the present time the company has charging sets in the following stations: Dedham, Bingham Road; East Boston, Central Square; Natick, Mechanic Street; Somerville, 110 Willow Avenue; South Framingham, 109 Waverly Street; Woburn, Lake Street. Ignition batteries are charged at the company's exhibition rooms, 33 Boylston Street, Boston.

The company's regular rates operate very favorably for the users of electric machines. It is possible for users of large quantities to run as low as 3 or 4 cents per kw-hour. This is very satisfactory for trucks and heavy wagons. If the consumption of electricity is small, as is naturally the case with pleasure vehicles, the rate per kw-hour is, of course, not so vital, but the net results for the customer will be equally satisfactory. Direct current is available for charging purposes in the city of Boston north of Northampton Street. In the other districts of Greater Boston alternating current only is available, but that can be handled with rectifier sets.

Flat-Rate Tungsten Service at Marion, Ind.

The Marion Light & Heating Company, of Marion, Ind., is putting out tungsten lamps in the business district on flat rates. The only lamp so put out is the 100-watt size. The proposition includes a reflector of the proper type for the place in which it is installed. In cases where a cluster or chandelier is employed the company also furnishes the cluster or chandelier. The lamp proper is purchased by the consumer at $1.30. The rate is $1.60 per month per 100-watt lamp for stores which are regularly open until 11 p. m. and $1.25 per lamp for stores which are open late but one night per week. The customer is left free to turn on and off these lamps as he pleases, the fact that he has to furnish his own lamp renewals being considered sufficient incentive for him to avoid waste of current. It will be noted that this rate of $1.60 per month per 100-watt lamp yields a revenue of $192 per kilowatt connected per year, and the $1.25 per month rate gives a revenue of $150 per kilowatt connected per year. Few meter installations yield as much gross revenue as this.

Central-Station Motor Load.

At a meeting recently in Pittsburgh of the American Association of Electric Motor Manufacturers, Mr. Fred M. Kimball presented a paper in which he discussed the relation of the association with central stations. While appreciating the recognition by central stations of the value of a motor load, he advocated the co-operation of the association in educating power users to the advantages of the electric drive.

Experience indicated, he said, that the best means to be employed for promoting business with central electric power stations is through interesting the stations themselves to canvass their clientèle through the intermediary of personal visits made by competent solicitors and demonstrators. From the motor manufacturer's standpoint the central station ought to be by far his best customer. As a rule, the credit of central stations is much better than that of its customers, and, a motor having once been sold to or through a central station, the pay for it need give comparatively little concern to credit departments.

The central station should be the best salesman for motor manufacturers for the reason that it has a vital interest in extending motor sales and because, owing to its local character and the intimate knowledge and relation which its managers and officials should bear toward the public in general, it has the first knowledge of prospective customers, the best means of determining their responsibility and worth, and is in the best position to study the problems in the application of motors in any given case either by means of its own staff or in conjunction with manufacturers' experts, and thus obtain that complete data which must be the foundation of every intelligent bid.

Central-station representatives are always available at short notice not only to anticipate and set right any incipient defect which may make itself manifest in a customer's equipment or in its operation, before actual damage results, but in case of necessity can usually bring corrective measures to bear more speedily and under better conditions of expert help or equipment than anyone else in the community. When the central station itself takes the responsibility and initiative of pushing power sales, it can intelligently seek for desired classes of power users with particular reference to filling in the valleys of its power curve, thereby building up the 24-hour load on an equable and satisfactory basis. The majority of central stations now maintain 24-hour service, or they should do so. The revenue from a well-distributed day-load then proves to be very profitable in comparison with the shorter lighting load, and allows the station to distribute its charges over a wider output and thus show a much better operating cost than when run for lighting with only incidental power. Activity on the part of the central station to fill up its own lines with lucrative power users is entirely rational from a business standpoint, even when this activity includes merchandizing and instalment sales, as against the policy of producing and selling energy only, and afterward relying largely on the sometimes erratic efforts of sundry manufacturers of energy-consuming devices to scour the town for customers.

The sale of energy and the sale of motors do, or should, go hand in hand. The service and the means for utilizing it ought to be introduced concurrently by one man. There should be no divided responsibility as between the sale of apparatus and the service connected with it, and it is only by actually dealing with electric power installations from inception to completion and operation that the solicitors of a central station can be furnished with that large knowledge and that experience which together are so indispensable in interesting new prospects and crystallizing their curiosity or interest into definite orders.

INTERIOR WIRING AND ILLUMINATION

Indirect Office Lighting.

Indirect lighting is used exclusively for general illumination in the new offices of the North Shore Electric Company, in the Home Insurance Building, Chicago. Tungsten lamps of 60 and 100 watts are placed within reflecting bowls of brass, suitably lined, and suspended about 3 ft. from the ceiling by chains. All the light is directed toward the light-tinted ceiling and thence generally diffused about the room. There are no bright spots and no glare, and the light is much like daylight, being very restful to the eyes.

Admiral Evans Compliments Grand Rapids Street Lighting.

The lighting of the downtown streets of Grand Rapids, Mich., by means of arches of tungsten lamps suspended from span wires across the street received a high compliment from Admiral Robley Evans at a dinner given in his honor following one of his lectures in Grand Rapids recently. As an introduction to his remarks at this dinner Admiral Evans said: "Before making any other remarks or telling any stories I wish to say that in my opinion you have the most beautifully illuminated city which I have ever visited." The tungsten arches on this street have been illustrated in past issues of the *Electrical World* and the plan has been copied by a number of other smaller towns. In fact, it is one which is within the reach of small as well as large cities.

A "Talking" Sign at Marion, Ind.

The talking sign which the Marion (Ind) Light & Heating Company has in front of its office has been mentioned several times in these columns in the past. While a sign of this kind is expensive in first cost, it has permanent advertising possibilities which can be obtained in no other way. The sign is used partially for advertising the company's own business and partially for advertising various public affairs and enterprises. Because of the fact that it is constantly changing, the public is always looking to see what is being said. As an example of the indirect advertising obtained from this sign, it was recently used to advertise some revival services that were being held in the city, and which were largely attended. The courtesy of the company in allowing its sign to be used in this way was so much appreciated that the evangelist publicly thanked the company from the pulpit.

Wiring of the Thirteenth Regiment Armory, Brooklyn, N. Y.

With the exception of a few company rooms, the armory of the Thirteenth Regiment, at Sumner and Jefferson Avenues, Brooklyn, has always been lighted with gas. In future, however, the immense structure will be illuminated by electricity, and the actual wiring of the building is now under way. Constructed some 15 years ago, the armory it not what would be strictly termed a fireproof building; nevertheless, the wiring of it has not been found an easy task. The requirements call for rigid conduit wherever it is possible to install it, and flexible conduit or cable where rigid conduit cannot be used. In the process of the work it was discovered that flexible conduit or cable could be more quickly and easily installed; but the rigid conduit was insisted on. There were no drawings available from which the construction of the building could be seen, nor were wiring plans used, the contractor being instructed where lamps were required and left to install them as best he could. As a result, walls had to be chased, floors taken up in places, notches cut in timbers, etc.

There will be about 2000 lamps connected in circuit when the wiring is complete, and these will receive energy from the direct-current mains of the Edison Electric Illuminating Company of Brooklyn. The rooms of the 12 regimental companies, as well as those of the officers, have no set plan of illumination or of wiring; some are lighted from chandeliers, while others are lighted by bracket fixtures. Each room has a panel from which all of the lighting circuits in the room are controlled. There are three main hallways in the front of the building, from each of which two corridors lead. Each of the front halls is lighted by seven 6-lamp Benjamin clusters fitted with Holophane shades. The lamps are controlled by three gang switches placed on the wall at the head of the main stairway. If the plan under contemplation is carried out there will be a tungsten lamp on each of the clusters, and the seven tungstens will be controlled by one of the gang switches. The other lamps will be of the ordinary type and half of them will be controlled by one of the gang switches and the rest by the other gang switch. Thus three intensities of illumination can be obtained and, of course, the energy consumption can be regulated to suit conditions.

At both ends of the front hall three gang switches are installed for controlling the nine clusters in the corridors leading from that hall. In this way a person can ascend the stairs, and by means of the switches at the head of the stairs place all or only part of the hall lamps in circuit. Walking along the hall to the corridors, he can light all or part of the corridor lamps from the switches at the end of the hall, and vice versa. The lamps in the front hall are fed from a panel board located in one of the rooms; but all the corridor lamps are fed from panel boards in the corridors themselves. The latter boards are not set in the walls, and the conduit containing the feeders to them are run up from floor to floor exposed. The panel boards in the rooms are set in the walls and all wiring to them is concealed.

The feeders, which are run in 2½-in. and 3-in. conduit, supply part of the rooms and part of the halls. There are three straight risers in the building for the circuits on the upper floors. "Buzz" risers run around the basement of the building and these are fitted with branch panels serving as cut-outs. Risers run direct from these cut-outs, which are placed under each company room to the panel board in the latter rooms. The risers to all panels are made up of rigid conduit, and, in running the branch circuits from the panel, flexible conduit was installed where rigid conduit was out of the question.

In places, the walls encountered were 16 ft. thick, while the general run of walls were 12 in. to 24 in. thick. In drilling through the 16-ft. walls two men worked 3½ days each in getting two holes through. The usual pipe drill was used, the men taking turns in hammering and holding the drill. The distance between ceiling and floor varies in parts of the building from 12 in. to 3 ft., there being many vaulted or hanging ceilings. Double floors were encountered throughout the work. The rigid conduit where it was used rests on the furring strips in the ceiling. When installing the conduit on the hanging ceilings, a hole was cut in the floor and a length or half-length of conduit coaxed into the hole, depending on the depth. This was then worked back and forth between the joists until it was brought in the proper position. In this way length after length of conduit was made up by a workman under the floor and the whole line of conduit pushed forward until the desired length was obtained. In some places the workman became so wedged in when crawling along worm fashion under the floor that another man had to go in at times to pull him out. When crossing rooms to get at brackets, etc., slots were cut in the floor for the conduit. In feeding from a panel to a lamp or lamps on the ceiling below, flexible cable was employed; in some instances the distance fished was as great as 80 ft., pockets having been taken up at suitable intervals. When crossing timbers, holes were drilled in the timber by an ordinary brace

and bit, the hole being at least 3 in. below the top of the timber so as to escape nails. Where such a procedure does not obtain, it is necessary to use an iron plate over the flexible conduit, if the latter is placed in notches cut in the timbers. The wiring work is being done by the Warren Electrical Company, of Brooklyn. Tungsten lamps will be used in the memorial hall, gymnasium and reception room. These will all hang pendant and will be fitted with prismatic shades. In all other places the ordinary carbon filament lamps will be used.

Features in the Wiring of the New York Metropolitan Tower.

The tower of the Metropolitan Life Insurance Company's Building, on Madison Square, New York, is the highest office building in the world, being 50 stories high and rising 700 ft. above the sidewalk. For the lamp circuits there are 171 cut-out cabinets installed and for the low-potential bell and telephone circuits 100 interconnection boxes have been provided. Owing to the great height of the building, the problem of supporting the feeder cables was not an easy one. In its solution use was made of an excellent cable support specially designed for the purpose. This support, which is made by the H. Krantz Manufacturing Company, is shown in Fig. 1 herewith. On every third floor beneath the panel boxes are sheet-steel cable support boxes 12 in. deep with channel-iron legs. Across the center of the box are T-irons, fastened to which, in the manner shown, are wedge-shaped porcelain insulators grooved vertically the better to hold the cable. When the latter has been hauled into position the upper wedge is bolted in place and the strain and weight are carried by the support. Fig. 2 shows the cable support in actual use. There is no tearing of the insulation, and any tendency of the cable to slip would cause the wedge to tighten its grip. The scheme possesses many advantages over the older method of supporting cables. In the first place, it does not require as much room; in the second place, it is applicable where other methods recommended fail. Moreover, a 90-deg. bend is not necessary. Heretofore the Code method usually employed for supporting cables consisted in using two or more insulating supports in a junction box, the insulators being placed so that the conductors will be deflected at an angle of not less than 90 deg. and carried a distance of not less than twice the diameter of the cable from its vertical position. Cables so suspended may be additionally secured to these insulators by tie wires. To support cables of large diameter by the latter method is not an easy job.

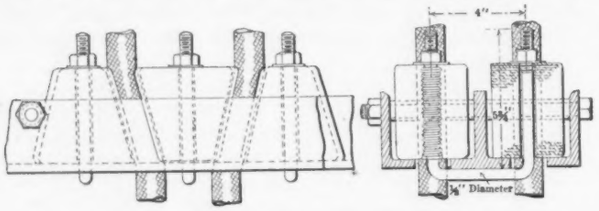


FIG. 1.—CABLE SUPPORT.

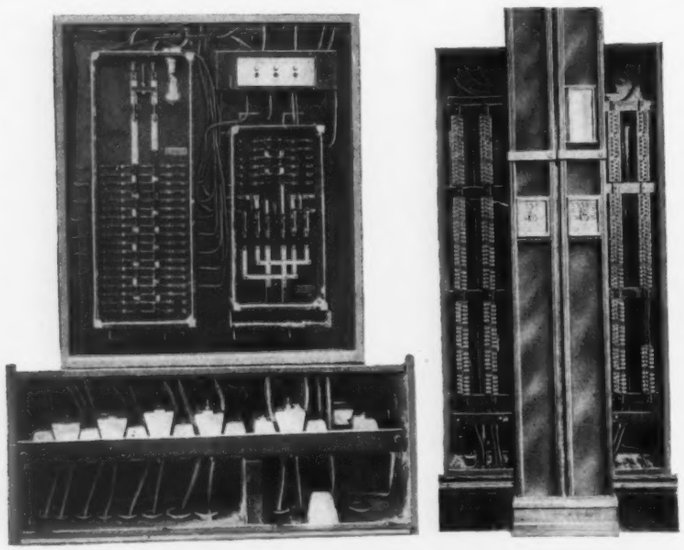


FIG. 2.—DOUBLE PANEL BOX AND CABLE-SUPPORT BOX. FIG. 3.—INTERCONNECTION STRIPS FOR LOW-POTENTIAL CIRCUITS.

The type of panel box used is shown in Fig. 2. Wherever possible two panels are combined in the same sheet-steel box. The boxes are 6 in. deep and are made of ⅛-in. steel. They are fitted with marbleized-slate frames, door linings and back, the latter being blocked out ½ in. from the back of the box so as to provide an air space. The panels have two-wire branches and mains with switches and enclosed fuses to the lighting circuits. All mains and sub-mains are controlled by knife switches and open-link fuses. The copper work is designed to carry 750 amp per square inch and the switches are designed with a current-carrying capacity of 50 amp per square inch for sliding contact. Special push-button switch-frames with gang plates are installed in the boxes with the panels, the arrangement of the panels and push-button switches being such that the trim and doors will be symmetrical. The boxes were made up complete with conduit holes drilled before being used on the job. The box is stamped out of one piece of metal, the corners being reinforced with angle iron, which is also used around the face of the box. Each panel is provided with a plug lamp socket for testing circuit fuses. The base of the lamp receptacle has two prongs which are spaced so as to straddle the circuit. The other portion of the lamp receptacle is always in circuit so that by plugging in the lamp one can tell at a glance whether the feeder is alive or dead.

The interconnection strips for the low-potential circuits are placed in cabinets alongside of the letter chutes in the corridors as shown in Fig. 3. The boxes are made of steel like the panel boxes, but have no slate back, although slate is used on the sides. The base of the strip is made of composition and is supported on iron. Two-nut binding posts are provided and there are two holes in the strip for each binding post. The binding posts are staggered so as to facilitate easy connection. The lead-covered cables are held by porcelain-enameled iron clamps bolted to the back of the interconnection boxes. The boxes on every third floor are made extra deep to accommodate the clamps.

The outlet boxes used in connection with the rigid conduit system are made of stamped steel with porcelain-enameled clamp outlet. The clamp is threaded so that much time is saved in running the conduit, the joint being made by clamping the pipe to the box instead of screwing it in in the ordinary manner. The tower is fed with energy by 68 450,000-circ. mil cables from the generating plant in the basement of the Metropolitan Life Insurance Building. The feeders are connected to the studs of switches on the rear of the switchboard, the nuts and lugs used being of forged copper. A pull-box is located above the switchboard for facilitating the installation of the cables.

New Telephone Patents.

SUBSCRIBER STATION DEVICES.

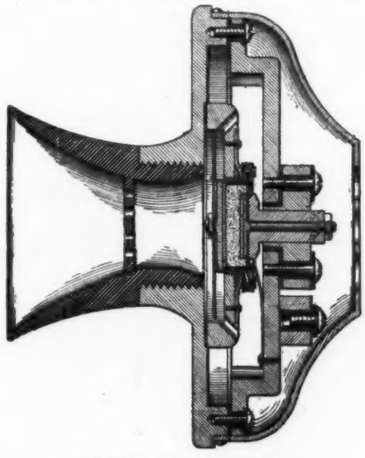
A pocket antiseptic device forms the subject of a patent granted to O. W. Hudgen, of Los Angeles, Cal. This comprises a flexible diaphragm, of some material such as rubber, stretched across an elastic ring of considerable strength. The ring is slightly smaller in diameter than the lip of the usual transmitter mouthpiece, and, in order to apply the device, the ring is stretched over the mouthpiece and allowed to take its own set upon the sloping outside wall of it. Of course, in this position the membrane becomes

stretched rather tightly over the face of the mouthpiece, shielding the user from the space within.

Mr. J. C. Fox, of Seattle, has invented an adjustable receiver supporting-arm, adapted to be clamped upon the upright of a telephone desk stand set and to support the telephone receiver at a convenient height for the ear of the user. The support comprises two similar slips of sheet metal, each carrying clips bent to include the other, so as to form a telescopic effect. One of these slips is attached to the desk-stand clamp, while the other carries an open U-clamp for holding the receiver. A spring latch is arranged to engage the hook-switch of the set whenever this is depressed. In order to release the hook-switch for conversation the latch is pushed to one side, thereby allowing the lever to rise.

NEW TRANSMITTERS.

There have been numerous advocates of the free-edge diaphragm for transmitters, the latest design of such a type being that of G. J. Edwards, which he has patented and assigned to the Kellogg Switchboard & Supply Company. This transmitter is shown in section in the accompanying illustration, from which it will readily be understood. It will be noted that the diaphragm, which is small, is carried entirely by the front of the microphone button, its edges being free. The transmitter



EDWARDS TRANSMITTER.

here shown is of the inverted solid-back type, an auxiliary diaphragm of mica serving to seal the button and at the same time to support its case upon the stationary electrode. In this particular transmitter the movable part of the button is held suspended between small, flat springs which bear on the opposing faces of its flange, and serve to hold the button in sensitive suspension without introducing initial strains in the mica diaphragm.

Another transmitter has been patented jointly by Messrs. S. A. and R. L. Stienbarger, of Augusta, Ill. In this transmitter the front electrode mounting is in the shape of a disk as large as the diaphragm and webbed to give it great rigidity. The front electrode support is screwed to the middle of the diaphragm. Upon its face is placed a thick felt pad with perforations such that it is virtually of cellular construction, the perforations being so placed that relatively thin walls of felt are left between them. Each of these cells is given a charge of granular carbon, and the rear electrode, of the same diameter as the front, is held up against the other face of the felt washer in a manner to seal all the cells. The device thus becomes a multiple-button granular transmitter without auxiliary diaphragms.

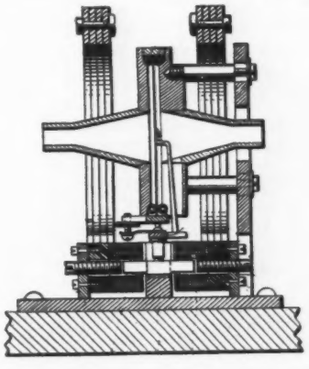
Mr. J. S. Wincrantz, of Pittsburgh, has invented a device for damping a transmitter when it is desired to speak in its neighborhood with the receiver off the hook and yet not have the voice picked up by the transmitter. Heretofore such damping has usually been done by putting the finger against the diaphragm in the older form of instruments, or covering the face of the mouthpiece with the hand in the latter form. Mr. Wincrantz's arrangement consists of a short nipple to be inserted in the transmitter mouthpiece between the mouthpiece proper and its normal mounting flange in the transmitter face. This nipple carries a damping plunger, adapted to be depressed against the middle of the diaphragm by means of a small lever projecting outside in a convenient position.

NON-INDUCTIVE TRANSMISSION SYSTEM.

With grounded circuits, with only two stations, one at either end, the grounded circuits paralleling a disturbing circuit, it has been almost impossible to overcome the detrimental effects of the inductive disturbance on a telephone line. Messrs. W. Condon and A. Barrett, of Kansas City, Mo., have jointly invented and covered by two patents a system for overcoming this difficulty. The transmitter battery is included in the middle of the line wire and each end of the line wire is led to a transmitter and thence to ground through the primary of a coil. The secondary of the coil is connected to the receiver. The windings of the coil are always so arranged that the primary and secondary are differential with regard to each other, an adjustable core being provided. It has been found that such a differential arrangement may be thrown out of balance by adjusting the core, and that there is a considerable range of adjustment within which a coil so arranged will act almost perfectly differentially for induced disturbing currents, while permitting a very effective repeating of telephone voice currents. It must be seen that by this adjustable differential arrangement the telephone currents become effective in the receivers at the two stations, while the induced currents pass through the induction coils without effect upon the receivers.

RECEIVER.

Such a practicable and efficient design for the telephone receiver was devised shortly after its invention that almost all receivers have followed the same general arrangement of parts. However, Mr. H. R. Stuart, of Wheeling, W. Va., has brought forward a very different type, for which he claims greater efficiency. This receiver is well shown in the accompanying illustration. Two polarized horse-shoe magnets are arranged with their planes parallel, one pole of each confronting the cylindrical armature piece and the other pole of each carrying, respectively, pole pieces presented to the ends of this armature piece. Each pole piece carries a solenoid, the pole pieces projecting partially through them and the armature piece largely filling the remaining core space. The cylindrical armature piece is attached by means of a linkage to the center of a mica diaphragm, confronted on either side by suitable air spaces and mouthpieces. The two



STUART TELEPHONE RECEIVER.

solenoids are connected to co-act in effecting the attractions and repulsions of the armature. The inventor claims that this form of receiver is more efficient than the usual one, his armature presenting sufficient mass of magnetic material to the poles to absorb properly the entire effect of the magnetic variations.

SWITCHBOARD CIRCUIT.

A three-wire common-battery switchboard circuit has been patented by W. Reid, of Chicago, the patent being assigned to the Kellogg Switchboard & Supply Company. This circuit is a sort of an adaptation of the usual Dunbar two-wire circuit to

three-wire working. To this end the cut-off relay contacts are connected to tip and ring springs of the jack, while the cut-off relay winding is joined to the jack sleeves, thereby forming the third part. Similarly, in the cord circuit, while the supervisory relays, serving as retardation coils, feed the ring side of the circuit in the usual manner, the supervisory control relays are connected to the plug sleeves to work in series with the cut-off relays. At the same time a retardation coil must be provided to feed energy from the battery to the tip side of the cord pair in lieu of the usual feed of the supervisory control relays.

Letter to the Editors.

Wiring Mills Without Regard to Code.

To the Editors of Electrical World:

Sirs:—The article in your issue dated Feb. 4 entitled "Wiring Modern Mills Without Regard to Code" appears to imply that the insurance companies alone are responsible for the National Electrical Code, that for some ulterior motive they have increased the cost of construction to a useless degree, and that the "Code" is an entirely unnecessary thing, and aside from an insurance interest, is of no value to the public. This spirit is certainly not a healthy one in which to view the electrical fire hazard. To be sure, insurance companies have supported the "Code" to a greater degree probably than any other body, but it is also true that electrical construction, even with all the care given it, has proved none too safe as a fire hazard, as the losses show. It is further true that any manufacturer who can otherwise afford to carry his own insurance, is extremely short sighted if he does not spend extra care, and, if necessary, additional expense, in making his electrical installation the safest which the combined experience of the country has developed.

The article would seem to suggest that cabinets for cut-outs are a useless precaution, and that the use of wire smaller than the Code requirements involves no hazard. It is probable that one-third of all electrical fires are caused by the blowing out of cut-outs, and that a number of fires have occurred by the use of too small wire even when in conduit. Where the question of drop is made the basis for fixing the size of wire, there is not much danger that wiring will not be of a size equal to that called for by the Code, especially if the runs are at all long; but the writer has within two years noted two fires from conductors too small in cross-section installed in conduit, and not properly fusing these wires.

As the American public is none too addicted to careful construction under any circumstances, an article tending to put a premium on negligence is, to say the least, of doubtful value.

Chicago, Ill. J. K. Oswald.

[Our correspondent views rather too seriously the case of wiring on which he comments. In special concrete construction designed to reduce fire hazard to a minimum, and where the installation is not subject to inspection under the National Code, an owner appears to be justified in departing from its requirements if he believes that the fire hazard will not thereby be increased. We should, however, regret very much if the article referred to has tended to create any impression unfavorable to the Code, which this journal has strongly favored from its inception 16 years or more ago.—Eds.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Commutation.—J. Liska.—An account of experiments made concerning the voltage required to produce a spark between commutator and brush. The author finds that for given materials of brushes and commutator there is a minimum value of the voltage at which a spark begins to be formed. This minimum voltage is independent of the maximum voltage actually occurring, of the current, of the current density, of the mean temperature of the commutator, and of the speed of rotation, but it is in general different for different directions of the current. For instance, when the current passes from a carbon brush to a copper commutator, the minimum critical sparking e.m.f. is 14.5 volts. If the current passes in the other direction, the minimum critical sparking voltage is 22.5. For other materials of brushes, the minimum voltages are given in the following table:

Brush.	Anode. Volts.	Cathode. Volts.
Le Carbone "Z"	14.5	22.5
Morganite "I"	14.5	16
Copper-carbon, Endruweit system	14.5	21
Copper, Endruweit system	14	14
Copper-brass, Ringsdorff	15	12.5

No sparks can occur at the commutator if the actual voltage is not greater than the minimum critical voltage. There is no great difference between the minimum critical voltages for metallic and carbon brushes, but this does not contradict the fact that the metallic brushes are more liable to heavy sparking. The explanation is that when the voltage gets higher than the minimum critical voltage, the strength of the spark which occurs is determined by the energy, and with metallic brushes the current is stronger on account of the smaller transition resistance.—*Elek. Zeit.*, Jan. 28.

Single-Phase Motor.—F. Roulaud.—An illustrated article on a single-phase commutator motor of the French Thomson-Houston Company for elevator service. It starts as a repulsion motor and becomes automatically a shunt motor when the normal speed has been reached. The motor exhibited has a rating of 2.2 kw. At starting it gives three times the normal torque and consumes 1.8 times the normal current.—*L'Industrie Elec.*, Jan. 25.

Lamps and Lighting.

Metallic-Filament Lamps.—An article pointing out the difference of the distribution of light from carbon-filament lamps and from metallic-filament lamps, especially from high-voltage metallic-filament lamps, on account of the particular design of the shape of the filament. For this reason reflectors such as used now for carbon lamps are not suitable for metallic-filament lamps. If metallic-filament lamps are to be employed chiefly for emitting light to the sides so as to illuminate the walls of a room, they hardly need any special reflector. But if the floor is to be lighted, the reflector should be so constructed as to increase the flux vertically below the lamp.—*Elek. Anz.*, Jan. 31.

Electric Lighting of Automobiles.—A. Soulier.—An illustrated article on electric lighting systems for automobiles at the recent automobile exhibition in Paris. The author describes at length two generators which give constant voltage at varying speed. One is that of Iglesis, described before in the Digest; the other operates on the "Phi system."—*L'Industrie Elec.*, Jan. 25.

Generation, Transmission and Distribution.

Spanish Energy Transmission.—An illustrated description of the plant now being built by the Siemens-Schuckert Company—already briefly mentioned in the Digest—of the Sociedad Hidroelectrica Espanola, has been designed to transmit as much as 30,000 hp at an e.m.f. of 66,000 volts. Each of the two branch lines from the Molinar power house to Valencia and Alcoy is 50 miles in length, that leading to Cartagena is 100 miles, and the line leading to Madrid 140 miles. The weight of the copper of the Madrid line, which is to consist of six wires of 50 sq. mm cross-section, amounts to 640 tons. The Molinar central station has been designed for five 5625-kva generators, wound for 6600 volts, 50 cycles, three of which are at present

installed. The e.m.f. is raised by five 6750-kva, three-phase transformers (three of which are at present installed) to 66,000 volts. Oil cooling is provided for eliminating the heat evolved, as shown in Fig. 1; the oil is propelled by an electrically driven

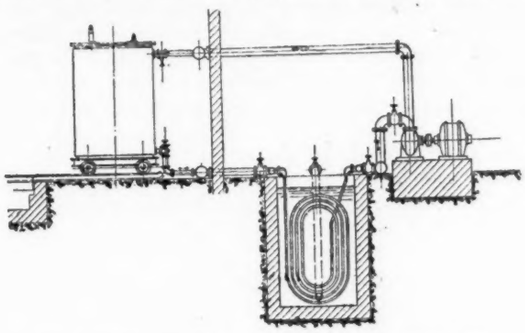


FIG. 1.—ARRANGEMENT FOR COOLING TRANSFORMER.

pump through coiled piping surrounded by flowing water. The total weight of each transformer is 38 tons, the transformer proper weighing 21 tons, the oil reservoir 6 tons, and the oil 11 tons.—Lond. *Elec. Rev.*, February.

Electricity on the Rand.—It has been officially announced in Johannesburg that the scheme prepared by Harper Bros., of London, for the supply of electric energy to 15 mines on the Rand has been accepted, and that the Victoria Falls Power Company will co-operate in putting the scheme into effect. The requirements of the mines in question amount to 300,000,000 kw-hours per year. The site selected is 14 miles from Johannesburg, and "the average cost of coal is such that it is estimated that energy will be generated at a less cost than at any other station in the world." The scheme includes the erection of a station of six 12,000-hp turbo-alternators. The contract has been adopted by the Victoria Falls Power Company, and that company has agreed to finance the new undertaking; in fact, the new company will form part of the great proposals of the Victoria Falls Company and the joint output of the two undertakings will reach almost immediately 500,000,000 kw-hours per year. The Allgem. Elek. Ges. and the Siemens & Halske Company are said to be interested in the scheme.—Lond. *Elec. Eng'ing*, Jan. 28.

Flexible Shaft Coupling.—A note on a British patent (18,221, 1908) of Siemens Bros. Dynamo Works and M. Kloss. Flexible couplings are sometimes used for turbo-generator sets in order to equalize any errors in alignment. Most couplings, however, exert a thrust parallel to the shaft axle, which interferes with satisfactory running; the present coupling is designed to overcome this objection. This coupling is similar to the Rateau pattern in that it has a number of steel pins; but in the latter type the pins are arranged parallel to the shaft, in consequence of which a force is exerted on the shaft in an axial direction. By arranging the pins radially between two concentric flanges, however, this trouble is avoided, and in the present pattern this arangement is adopted. The pins are passed through holes in the outer and inner flanges, and are kept in position by a ring screwed on to the outer flange.—Lond. *Elec. Eng'ing*, Jan. 28.

Traction.

Rolling Stock for Railways.—P. DAWSON.—A continuation of his long illustrated serial on electric traction on railways. The author first considers rolling stock as being divided into that for (1) main-line, (2) suburban-line and (3) metropolitan traffic, and then suggests a classification depending on the arrangement of the doors. After considering the conditions which influence the design of rolling stock he discusses the influence of design on the construction, and finally adopts the classification of all-wood and all-steel cars.—Lond. *Electrician*, Jan. 29.

Single-Phase Traction.—A fully illustrated description of the Seebach-Wettingen road, including a description of the power plant, substation, and line.—*La Revue Elec.*, Jan. 30.

Caucasus.—T. NALDANIEN.—A note on a proposed electric road through the Caucasus. The length will be 130 miles. Trains of 176 tons weight will be hauled by 50-ton electric locomotives. The power required will be 13,500 kw. Two large hydro-electric stations will be erected and energy will be supplied along the line for lamps, motors and tramways.—*La Revue Elec.*, Jan. 30.

Installations, Systems and Appliances.

Cost of Electric Energy.—A. OSCHINSKY.—The conclusion of his long illustrated article on the new electricity works of the city of Brussels. The author first sums up the operation of the power plant and of the five substations and gives figures for the guaranteed efficiency of the machines and for the efficiency which they have in actual operation. He finally gives a detailed statement of the cost of energy generated in this plant during 1907. Bituminous coal from Belgium of about 7900 calories heat value is used. The boiler plant has an efficiency of 53 per cent. The number of kw-hours generated during the year was 9,718,000. The coal consumption was 1.38 kg per kw-hour generated. Of the total electrical energy generated they are lost in the power plant 10.2 per cent; in the high-tension cables 3 per cent, and in the substations 26 per cent, so that the efficiency of the whole electric installation is 64 per cent. The total yearly cost of the generating plant, including interest and amortization, is $146,017, or 1.5 cents per kw-hour. The total yearly cost of the cable network and of substations is $60,165, or 1.7 cents per kw-hour sold. The total yearly expense was therefore $206,182, or 3.315 cents per kw-hour, as 6,219,000 kw-hours were sold. The value 3.315 cents per kw-hour sold is the sum of the following items: Coal in station, 0.89 cent; oil in station, 0.17 cent; water in station, 0.03 cent; cleaning materials in station, 0.04 cent; oil and cleaning materials in substations, 0.045 cent; wages in station, 0.31 cent; wages in substations, 0.21 cent; repairs in station, 0.02 cent; in substations, 0.04 cent; maintenance of battery, 0.11 cent; interest and amortization of generating plant, 0.885 cent; interest and amortization of substations, 0.57 cent. The total is 3.32 cents per kw-hour sold, which is considered a rather good result for a station which is principally for lighting. In future it is thought it will be possible to reduce the coal and oil consumption, and also the amount of wages paid, although no great hopes are entertained with respect to wages since the plant is a municipal one. The comparatively good result is due chiefly to the low interest which the city has to pay. The interest on the capital invested is 2 5/6 per cent, while the amortization is based on a period of 40 years, so that on the whole 4.21 per cent are charged.—*Elek. Zeit.*, Jan. 28.

Lightning Protection.—An account of the experience gained during the season of 1908 on lightning protection on the Taylor's Falls transmission system of the Minneapolis General Electric Company. The results of two seasons' operation are summed up as follows: It is impractical to try to protect the line insulation after the more violent storm disturbances have got onto the line. Overhead ground wire, properly installed, may be relied on to shield the line from the greater part of such disturbances and will prevent interruption or damage except under extraordinary conditions. Lightning rods on the poles are an added protection to the line insulation and poles, and separate lightning-rod poles may be of sufficient value to warrant their installation at points especially exposed to direct lightning stroke. Horn arresters, particularly with two or more horns in series and selective shunting resistances, are of definite value in relieving the stations from excessive disturbances, but should be set so as to discharge only in case of unusually violent disturbances, as their discharge is at times liable to disturb unduly the line regulation or to interrupt the service momentarily. The aluminum cell type or electrolytic arrester is the most reliable and effective protection yet devised for station apparatus, but should either be disconnected from the line by the attendants in case of long-continued discharge or be automatically controlled or disconnected by fuses or other devices. With proper shielding of the trans-

mission line and the installation of proper station arresters, interruption to service and damage to the line and stations may be practically eliminated, except in rare cases, such as direct lightning stroke reaching the conductors or other abnormal disturbance.—*Stone & Webster Pub. Serv. Jour.*—February.

German Central Station.—L. Mueller.—An article on the central station of Hildesheim in Germany. The plant contains three steam turbines driving direct-current dynamos. Two are of 200-kw rating and the third of 300-kw. The turbo-generators run at 3000 r.p.m. and generate direct current at from 450 volts to 560 volts for lamps, motors and traction. The distribution network is on the 2 x 220-volt, three-wire system. Energy is sold either on a double tariff (with certain evening hours during the winter being exempted when no energy is permitted to be consumed) or on the maximum demand system. On the latter system, about 1¼ hours of maximum energy consumed daily during the month are charged at 15 cents per kw-hour, while the balance is charged at 2.5 cents per kw-hour. Energy for motors is supplied under the same conditions. The tariffs have proved very satisfactory and have resulted in increasing the time during which the total maximum load is used per year from 1100 to 2300 hours, in spite of very little industry in the city. The receipts per kw-hour sold are about 4.75 cents.—*Jour. f. Gasbel.*, Jan. 30.

British Central Stations.—The yearly statistical tables of British electricity supply stations with no tramway load. In the whole 267 stations are analyzed, very complete data being given as to the history of the plant, the system used, equipment, connections, and rate charged.—Supplement to Lond. *Electrician*, Jan. 22. A further statistical table covers British towns which take an electricity supply "in bulk." There are 369 towns of this kind and the statistical data given are equally complete. —Supplement to Lond. *Electrician*, Jan. 29.

British Central Stations.—Diagrams showing graphically the growth of British central stations during the last year. In the provinces municipally owned stations are predominant, while in London the reverse is the case. The development of "power" companies supplying electric energy "in bulk" has been going on since 1904 in a very rapid way in extending the connections to their mains, especially during the last two years.—Lond. *Electrician*, Jan. 29.

British Lighting and Traction Stations.—A statistical table on 146 of such stations, giving data on history, equipment, connections and rate of charging.—Supplement to Lond. *Electrician*, Jan. 29.

German Central-Station Statistics.—Statistical tables on German central stations and the cost of energy generation. The data contained in the article have already been noticed from German sources.—Lond. *Electrician*, Jan. 29.

Proposed German Electricity and Lamp Tax.—G. Dettmar. —The author, who is general secretary of the German Association of Electrical Engineers, states that the proposed tax on electricity and gas has been attacked so furiously from so many sides that it will hardly become a law. There are, however, people who think that a tax on lamps (which forms a part of the original proposal) might be acceptable. The writer tries to show that such a tax would not bring the amount which is expected from it, and he further endeavors to show that it would be unfair, because one-fourth of the money would have to be produced by users of gas lamps and three-fourths by users of electric lamps.—*Elek. Zeit.*, Jan. 28.

German Tax on Electricity and Gas.—A further protest of the German Society of Gas and Water Engineers against the proposed gas tax; an abstract of G. Dettmar's paper before the German Association of Electrical Engineers; and a protest by the Association of Manufacturers of Gas Incandescent Mantles against the proposed tax on lamps.—*Jour. f. Gasbel.*, Jan. 23.

Free Oscillations in Long Conductors.—I. Doery.—The first part of a mathematical paper on free oscillations in long lines with special reference to the use of condensers for protecting the line against sudden dangerous rises of voltage. The paper is to be concluded.—*Elek. u. Masch.* (Vienna), Jan. 31.

Wires, Wiring and Conduits.

Conduit Wiring.—L. M. Waterhouse.—A paper read before the (Scotch) Electrical Contractors' Association. To protect electric conductors from mechanical, chemical and electrolytic damage, the author considers iron tubes to be most suitable. The couplings and T-pieces should be made of malleable cast iron, and their corners should be rounded off to facilitate "drawing through." The proper use of junction boxes with porcelain interiors plays a most important part in planning a satisfactory system of distribution. Continuity and earthing are not only advisable, but are in many cases specified by the inspecting authorities. These very necessary precautions do not, however, altogether guard against fire risk, unless contact with gas pipes is avoided. To prevent troubles from condensation and water from destroying the insulation, great care should be taken in handling wires during erection, and attention should also be directed to cleanliness of the rubber after the vulcanizing process. With regard to switches and ceiling rosettes, it is recommended that such fittings should not be mounted directly on the metal outlet boxes. It is better to place a small insulating disk between the two, thus greatly improving the insulation of the system. To guard against electrolytic trouble the author states that "an enamel with a linseed oil base, and containing a very efficient rubber substitute, has been discovered, and gives a very good protective to the conduits. Tests on conduits covered with this enamel show that the tubes can be bent to curves of very small radii without cracking or scaling, and that the insulation resistance is extremely high."—Lond. *Electrician*, Jan. 29.

The Earth as Conductor.—E. Brylinski.—The conclusion of his long report on the possibilities of using the earth as part of an electric circuit. The report is distinctly favorable to making use of the earth in such a way under certain conditions. —*L'Industrie Elec.*, Jan. 25.

Fuses.—W. Klement.—The first part of a paper in which the author gives an illustrated historical review of the different forms of electric fuses.—*Elek. Zeit.*, Jan. 28.

Electrophysics and Magnetism.

Thermal and Electrical Conductivity.—N. F. Smith.—Since the ratio of the thermal to the electric conductivity is approximately constant for all metals it is natural to expect that anything which produces a change in the one would cause a corresponding change in the other. The electric resistance of small wires increases when under tension; up to the elastic limit, the increase in resistance is nearly proportional to the stretching force; beyond this state, the change is roughly proportional to the elongation. Bismuth shows a change in the opposite direction. The author has studied whether any changes in the electric resistance are accompanied by a parallel change in thermal resistance. The author subjected metal bars to a stretching force and studied the two changes. In every case the electrical resistance increased with increasing tension; that is, the conductivity diminished. These results are in substantial agreement with those obtained by other experimenters on resistance wires. However, the conditions of this experiment were not suited to a highly accurate determination of the effect. It is, however, of interest to note that the changes in the thermal conductivity produced by moderate tensions are opposite in direction to those in the electrical and are of an order of magnitude about 10 times as great. Some rather rough experiments upon the effect of bending bars of iron and copper so that a large permanent deformation was produced seemed to show a marked decrease in thermal conductivity of from 5 per cent to 8 per cent. This is to be expected from the behavior of copper bars when stretched upon their elastic limit.—*Phys. Rev.*, February.

Theory of Oscillations.—F. Emde.—A mathematical paper in which the author shows that Steinmetz's method of using complex quantities for the calculation of alternating-current phenomena can be employed with advantage for the treatment of certain problems of the theory of oscillations.—*Elek. u. Masch.* (Vienna), Jan. 24 and 31.

Units, Measurements and Instruments.

Electric Regulation of Temperature.—H. M. RANDALL.—An abstract of an American Physical Society paper describing a high-temperature regulator, the arrangement of which is shown in Fig. 2. The variation in the temperature of the oven is detected by a thermocouple or a platinum resistance thermometer. The coil of the galvanometer in the potentiometer or

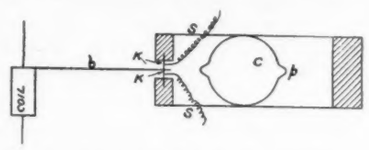


FIG. 2.—HIGH-TEMPERATURE REGULATOR.

the Wheatstone-bridge circuit is provided with a light aluminum boom, *b*. With rise of temperature this boom moves between two spring jaws, *s*, which open and close upon one another regularly, the movement being caused by the rotation of the cylinder *C*, provided with the elevations *p*. The cylinder *C* is driven by a motor at low speed. The platinum contact strips *K* are insulated by hard-rubber blocks from the steel springs *s*, and just escape contact with each other when the boom is not between them. The diameter of *C* is such that the springs *s* pinch the boom with considerable force when it is between them in the position shown in the figure, thus completing a battery circuit containing an electromagnet; this latter, responding, shunts part of the heating current of the oven. As the oven cools the boom moves from between the jaws through its zero positions to a second similar pair of jaws on the opposite side, which operate to open the shunt circuit. With proper adjustment no strain is put upon the galvanometer suspensions when the jaws close upon the boom, and, therefore, light suspensions may be used. With this arrangement it has been possible to maintain for hours temperatures in the neighborhood of 1000 deg. C. in the oven employed, without any variation in temperature occurring which could be detected by a thermocouple.—*Phys. Rev.*, February.

Cadmium Cell.—P. I. WOLD.—A note on the short-circuiting of cadmium cells. The author studied the gradual recovery of a number of cells after they had been subjected to a short-circuiting for from 15 seconds to 10 minutes.—*Phys. Rev.*, February.

Telegraphy, Telephony and Signals.

Long-Distance Telegraphy from England to India.—Notes on recent progress in long-distance telegraphy, due to the completion of a new telegraph line in Persia and India. Direct telegraph connection has now been established between London and Calcutta, a distance of over 6900 miles, which is a record in long-distance telegraphy. Between London and Teheran there are 10 automatic relay stations, and direct Wheatstone automatic working between these cities, a distance of 3800 miles, has been used exclusively since 1903. In the year 1905 direct working was extended from London to Manchester and Liverpool. There are two relay stations on the new line from Teheran to Karachi, so that including the station at Teheran, direct working is accomplished between London and Karachi, a distance of 5347 miles, by means of 13 automatic relay stations. A Wheatstone receiving instrument can be put in circuit at each relay station, and by this means it is possible to ascertain the section of the line on the relay apparatus that is faulty if the messages are not being received distinctly. Up to some eight months ago, the paper-slips for passing through the transmitting apparatus were perforated by hand, but this operation is now done with the aid of a device known as the Kotyra keyboard perforator, which has been especially developed for use with the Wheatstone system. This apparatus consists of three electromagnets and a keyboard. The former are mounted side by side on a framework of metal designed to accommodate an ordinary Wheatstone perforator immediately underneath. Three brass pads, one fixed to each plunger, abut on the dot, space and dash keys, respectively, of the perforator, and when an electromagnet is energized, a blow is given to the respective key of the perforator, and a dot, dash or space signal is punched. A pinion driven by an electric motor runs beneath the whole of the keys. Each key has a lever connected to it, on the under side of which is a rack. When a key is depressed, the rack engages in the pinion, and is carried along a certain distance, after which it is returned to its position of rest by means of a spring. The key is then permitted to rise back to its normal position. A contact spring is fitted to each lever, and this spring passes over a series of metallic studs when the rack is in contact with the pinion. These studs are connected to the electromagnets, and as the contacts are rubbed by the spring, the corresponding electromagnets are successively energized, and the paper punched. The coils of the electromagnets, and also the motor, are wound for any e.m.f. between 80 volts and 120 volts, and the current taken by the apparatus is about 0.6 amp intermittently.—Lond. *Elec. Eng'ing*, Jan. 28.

Wireless Telephony.—A. CARLETTI.—An illustrated description of the system of Q. Majorana, who recently succeeded in obtaining wireless telephone communication over a distance of more than 300 miles. To obtain undamped electric oscillations, he formerly employed a revolving oscillator. This consisted of a motor on whose shaft was fixed a disk of ebonite carrying on its opposite faces two rings of metal. On these rings there pressed two brushes which were connected in the discharge circuit. Two steel wires 0.08 in. in diameter and 2 ft. 4 in. long were fixed to the metal rings and moved parallel to them. Their ends, across which the discharge took place, were brought up to one another. These two oscillating wires were connected to the secondary of a stationary transformer, whose primary received energy from the town mains. When the motor was running the two oscillating wires rotated, and the sparks which passed between them were blown out quickly by the air, and were, therefore, considerably subdivided. By means of the artifice he was able to produce 20,000 sparks per second. To modify these sparks to correspond with speech, Majorana designed a liquid microphone. This microphone consists essentially of a small glass tube through an opening in which a stream of slightly acidulated water flows under a known pressure. The small tube is fixed to a microphone membrane and therefore vibrates with it. This liquid jet falls between two platinum electrodes, thus establishing an electrical connection between them. When the microphone membrane is spoken into, in the same way as in an ordinary microphone, it vibrates and the small tube following its movements causes constrictions in the jet, and thus varies the resistance between the platinum electrodes. Quite measureable fluctuations are produced in the

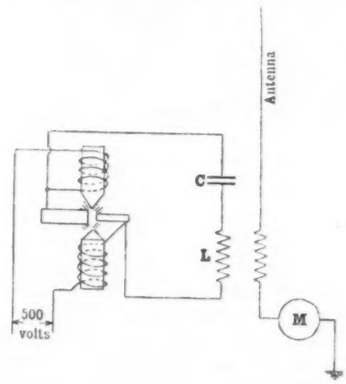


FIG. 3.—DIAGRAM OF TRANSMITTING ARRANGEMENT.

electric resistance, and they accord perfectly with the sounds emitted. This microphone has been tried on the ordinary telephone, and has given very satisfactory results. More recently Majorana uses Poulsen's method of producing undamped oscillations instead of his old revolving oscillator. Fig. 3 shows the arrangement adopted in the transmitting station. The arc, which is enclosed in a hydrogen atmosphere, is established be-

tween two electrodes, one of carbon and the other of copper. The oscillating circuit is made up of a condenser *c*, and the primary winding of a Tesla transformer. The secondary of this transformer is connected with the antenna, and to earth through the liquid microphone *M*. Sound waves corresponding to conversation modify the resistance of the circuit by means of the jet of water, and, therefore, also the oscillations radiated by the antenna. The arrangement adopted at the receiving end (Fig. 4) includes a new oscillatory circuit, a second antenna and a thermo-electric detector composed of two metals in contact, which under the influence of the oscillations becomes more or less heated, thus producing modifications in the current corresponding to the electric oscillations and, therefore, with the

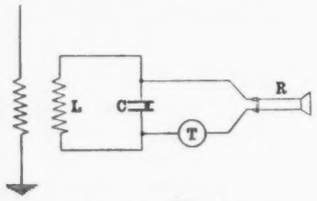


FIG. 4.—DIAGRAM OF RECEIVING ARRANGEMENT.

voice of the person speaking at the transmitting end. These variations in current are reproduced in the telephone receiver *R*.—Lond. *Electrician*, Jan. 29.

Inductance Troubles on Telegraph Lines from Traction Systems.—E. Mirabelli.—An abstract of a paper read before the first international conference of Telegraph & Telephone Engineers at Budapest. The paper deals with the experience gained on the Valtellina electric railway in Italy where a telegraph line runs along the road. The main disturbance was found to be due to induction from the two service conductors of the 3000-volt, secondary, three-phase system feeding energy to the trains. There was little disturbance due to leakage, except when heavy trains were running close to the substations. Differences of earth potential exceeding five volts between substations were noted. The total interference rendered telegraphic communication quite impossible, and the only practicable cure was to double the wires for the whole length adjacent to the railway, and insert a repeater at each end. Even then the insulation of the lines had to be very carefully maintained to avoid disturbance. Trials of closed circuits working with fairly high current were therefore made, and found to ameliorate the conditions considerably. It was, in fact, found possible to withdraw the repeaters at one end, and simply to earth the second wire at that point. The circuits are now working in this way wtih fair success. The alternatives suggested for further trial and consideration are: (1) the application of condensers and inductive resistors in the telegraph circuits in order to separate the currents of different natures; (2) doubling the aerial telegraphic wires wholly or in part; (3) laying underground cables along the railway for loop working; (4) arranging that motors shall use continuous current at low voltage in the secondary circuits or three-phase secondary currents, fed to motors by symmetrically placed conductors. The Italian administration is continuing experiments on the subject.—Lond. *Elec. Eng'ing*, Jan. 29.

Transmission of Photographs.—A description of a new process for transmitting photographs electrically by a French inventor, C. M. Senlecq. He does not use a selenium cell. The conversion of luminous shades into variations of current intensity is effected without any specially prepared plates, immediately in the photographic camera. The light rays strike, in the focus of the camera, a slide covered at its front with a glass plate and designed at its back as a microphone, connected with the transmission line in the same way as is the microphone of a telephone plate. The interval between the glass plate and the microphone, which is only about 1 in. in thickness, is filled with a mixture of hydrogen and chlorine gases, prepared in the dark under a given pressure. The glass plate inside the camera is covered with a rotary screen, in which are a series of openings arranged in spiral lines (Fig. 6), which is designed accurately like the one used in the selenium apparatus of the same inventor, but the selenium specks are replaced by perforations. In Fig. 5 *F* is the plate of an Ader microphone consisting of a very thin plate or a membrane, the vibrations of which correspond to the light shades acting on the gas mixture; *G*, in Fig. 6, is a screen 1 m or more in diameter, which, during each rotation, covers every portion of the picture in very close line. The two gases are contained in opaque receptacles, *H, Cl*. The glass plate, in a state of rest, is covered by the screen. The conversion of the different light shades into fluctuations of current intensity takes place as follows: A mixture of equal

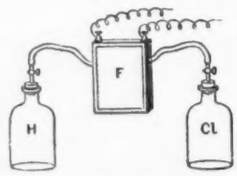


FIG. 5.—TRANSMITTER.

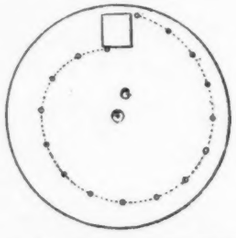


FIG. 6.—DISTRIBUTING DISK.

parts by volume of chlorine and hydrogen can be maintained only in perfect darkness. Under the action of even diffuse light a combination of the two gases to hydrochloric acid takes place at a rate corresponding to the variable luminous intensity; in fact, in bright sunlight, this combination is so violent as to result in explosion. Experiments conducted by the inventor show the combination of the two gases in the camera always to occur instantaneously, exerting on the microphone plate an action identical to that of sound vibrations. The phenomenon in question thus becomes a purely chemical effect producing a mechanical action—namely, vibrations of the microphone, which in turn are transmitted to the remote end of the line, in the shape of electric fluctuations. Owing to its strong chemical affinity for water the hydrochloric acid is absorbed immediately after production. The luminous shades of the original picture are thus converted into microphone vibrations which in turn, with fluctuations of electric current, are transmitted to the receiving station, there to be used for reproducing the picture by means of any tele-photographic receiving apparatus. The inventor uses in this connection his tele-electroscope and shade scale. It is claimed that the rapidity of transmission is quite high.—Lond. *Elec. Rev.*, Jan. 15.

Exports to Japan.—E. Schiff.—A discussion of the possibilities of exporting machines from Germany to Japan, on the basis of a communication by H. Noelke, a German engineer in Japan. The imports into Japan in 1907 are given in the following table, 1 yen being 50 cents:

	General machinery. Yen.	Locomotives, cars, etc. Yen.
Great Britain	14,674,028	907,240
United States of America	8,310,333	2,108,914
Germany	3,248,575	136,564
Total imports	26,936,865	3,280,334

Imports of general machinery into Japan, therefore, come 55 per cent from England, 31 per cent from the United States and 12 per cent from Germany. The writer gives some hints as to means for extending the export trade and he thinks that agencies are often given indiscriminately to firms in Japan, who thus become the sole agents for a great many firms who are real competitors. It is necessary to send engineers to Japan as representatives, and the representatives should be not only in the cities on the coast but in the interior. A single firm should not get the sole agency for the whole of Japan. The manufacturers in Germany should show their works to visiting engineers from Japan, since secrecy is good for nothing and only hurts the trade. In spite of the very great commercial activity in Japan since the close of the war only three or four machinery factories have been completed. Japan will therefore have to import machinery from other countries for a long time to come. The exporter should send his own engineer to Japan. The

formation of syndicates of firms exporting similar kinds of machinery is recommended. Attention is called to the Japanese World Exposition in 1912.—*Elek. Zeit.*, Jan. 28.

Increasing Self-Inductance of Telephone Lines.—M. MINOTTI.—An article on the best method of increasing the self-inductance of a telephone line uniformly all along its length, without loading it at intervals with inductance coils. There are two means of doing it. One is to use an iron core around which the copper conductor is wound. The other is to use a copper conductor around which an iron wire is spun. The author shows in detail that the second method is the preferable one, as it is more effective for the same cost.—*Elek. Zeit.*, Jan. 28.

Wireless Telegraphy.—J. BETHENOD.—A mathematical article on the calculation of the proper frequency of an antenna excited indirectly by an autotransformer arrangement.—*La Lumière Elec.*, Jan. 30.

NEW APPARATUS AND APPLIANCES

The Use of Telephones in Generating Stations.

BY W. HARVEY KELLEY.

THE rapid growth of American industries within the past 25 years has made it difficult for one to keep pace with them. Large enterprises have been built up so quietly that the general public has been almost unconscious of their existence. The two Waterside stations of the New York Edison Company are a striking example of such conditions, being the scene of tremendous activity little dreamed about and seldom heard of by persons outside the electrical profession.

These central stations, through the medium of 26 substations, supply electrical energy to the Borough of Manhattan and the Borough of the Bronx. The Edison service is used by approximately 75,000 consumers. There is an equivalent of over 6,000,000 16-cp lamps in every-day use, the electric motors driven aggregating 205,373 hp. Alternating current at 6600 volts is distributed from the Waterside stations to the various substations and is there transformed by means of rotary transforming apparatus into direct current at 120 and 240 volts. This is fed into a three-wire system from which the customers are supplied. The company uses a large number of storage batteries in different sections of the city to equalize the load upon the machines.

In this connection it is interesting to note that all this vast amount of electrical energy is directed chiefly through the agency of the telephone. Through a Western Electric private telephone exchange in Waterside station No. 1 the switchboard operators there are in direct and immediate communication with Waterside station No. 2, and with each of the 26 substations. In addition to this, Waterside station No. 2 is equipped with a Western Electric private telephone exchange and an intercommunicating telephone outfit, as shown in Fig. 1.

The intercommunicating telephone system was installed by the Western Electric Company, in January, 1906. It has had a three-year test, and has proved to be one of the greatest time savers connected with the plant. The equipment has a capacity of 20 lines, 10 of which are in actual use. The others are being held in reserve for future galleries or stations as they may be added. Those in use are connected as follows: Substation, battery room, bus house, east; bus house, west; selector gallery, east; selector gallery, west; transformer gallery, automatic gallery, east; automatic gallery, west, and high-tension board.

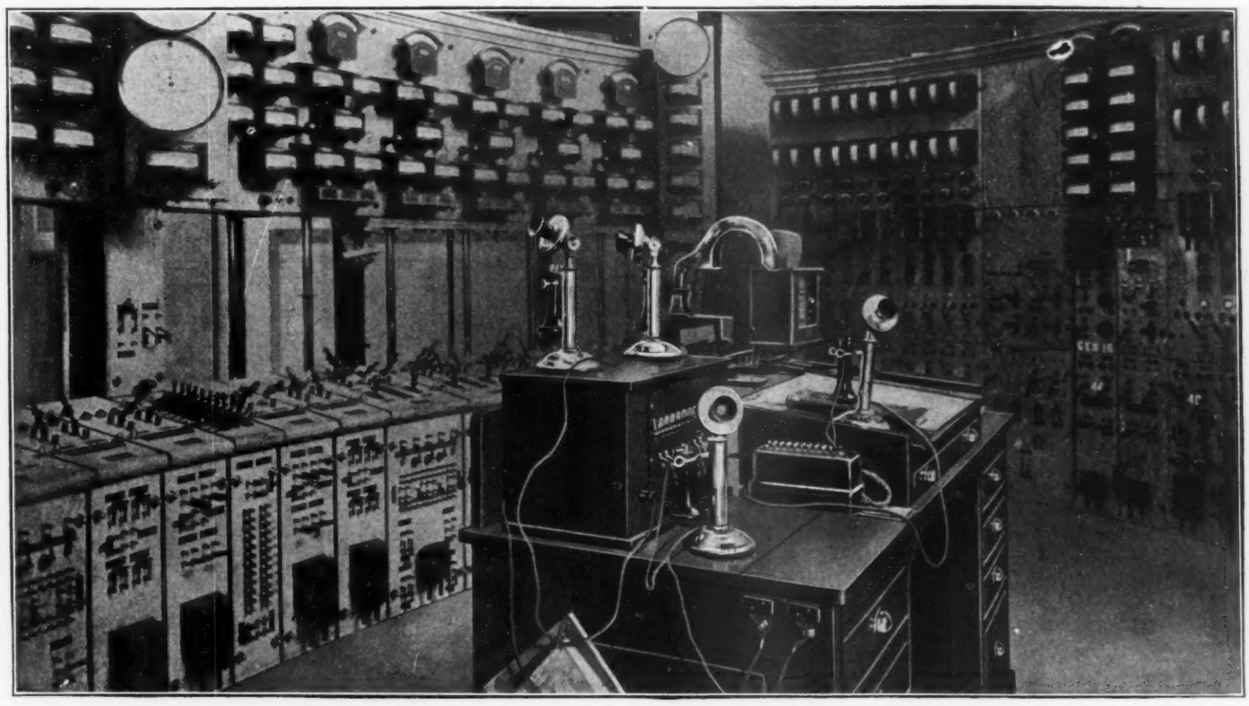


FIG. 1.—INTERCOMMUNICATING TELEPHONE EQUIPMENT IN WATERSIDE STATION NO. 2 OF THE NEW YORK EDISON COMPANY.

Fig. 2 illustrates the type of intercommunicating telephone equipment used at the Waterside stations. The efficient design of the equipment, its rigid, reliable, mechanical construction, and its pleasing appearance are worthy of note. The selective apparatus, as will be seen, is of the key or push-botton type mounted in an enameled iron case. The buttons are labeled according to the telephone or station with which they are connected. The home button being labeled "Ans." To make a call it is only necessary to press the button opposite the station desired, then press the button labeled "Ring" and remove the receiver from the hook. To answer a call one has simply to

press the button labeled "Ans." and remove the receiver. All the buttons are nickel-plated with the exception of the ringing and answering buttons, which are of red fiber. Each key except the ringing key is engaged by a tumbler common to all the keys, and when depressed it is held locked down until another key is pressed, when the key previously used is automatically released and returned to normal.

In the past, and before the adoption of the intercommunicating system, it was necessary for the switchboard operator to call the gallery repair man with whistle blasts, often necessitating a wait of from 5 to 10 minutes; now the repair man is on hand within nearly as many seconds. With the intercommunicating system the switchboard operator signals the repair man, who is seldom more than 25 ft. from a local telephone station, by ringing his telephone bell. The bell is answered by the repair man over the telephone, thus establishing immediate and direct communication with the switchboard operator who tells him just what is needed. In this way the trouble is adjusted in much less time than it would take the repair man personally to report to the switchboard operator and receive instructions as he can bring the necessary tools and supplies with him.

It is estimated that this system is used in the Waterside station at least 200 times a day. By saving the time the em-

FIG. 2.—INTERCOMMUNICATING TELEPHONE EQUIPMENT.

ployees would otherwise require in traveling around the plant enables them to accomplish more and better work and safeguards the station in cases of emergency. The feature of the intercommunicating system is that it requires no special telephone operator and therefore has very low operating expense. It is available for use at all hours of day or night, as connections are made independent of a telephone operator. Aside from these advantages, it puts the manager of a plant in touch with every one of his departments at a moment's notice.

Brass Insulated Bushing.

The Sprague Electric Company, New York, has developed a new brass insulated bushing to comply with the rule of the National Board of Underwriters which requires that lamp sockets must be insulated from the armor of armored cord. The bushing consists of two brass parts and two composition insulating wedges, as shown in Fig. 1. The brass parts are insulated from the steel armor by the insulating wedges which grip the armor as the bushing is screwed into place. In Fig. 2 are shown the parts assembled. The simplicity of construction of these bushings and their ade-

FIGS. 1 AND 2.—BRASS INSULATED BUSHING.

quacy as regards the requirements of the rule, leave little to be desired in this class of devices.

Flaming Arc Lamp with Vertical Electrodes.

The accompanying engravings illustrate the features of the Alba flaming arc lamps of the Siemens-Schuckert Works, the American distributor for which is the Charles L. Kiewert Company, of Milwaukee, Wis. Fig. 1 shows the mechanism of the direct-current lamp, Fig. 2 shows the details of the alternating-current lamp, and Fig. 3 illustrates the methods of ventilating the globe by means of an ash tray. The feature of the lamp is the co-axial vertical arrangement of the electrodes. The diameter of the chemical core carbons is about double that of the inclined carbons, while the length is a little more than

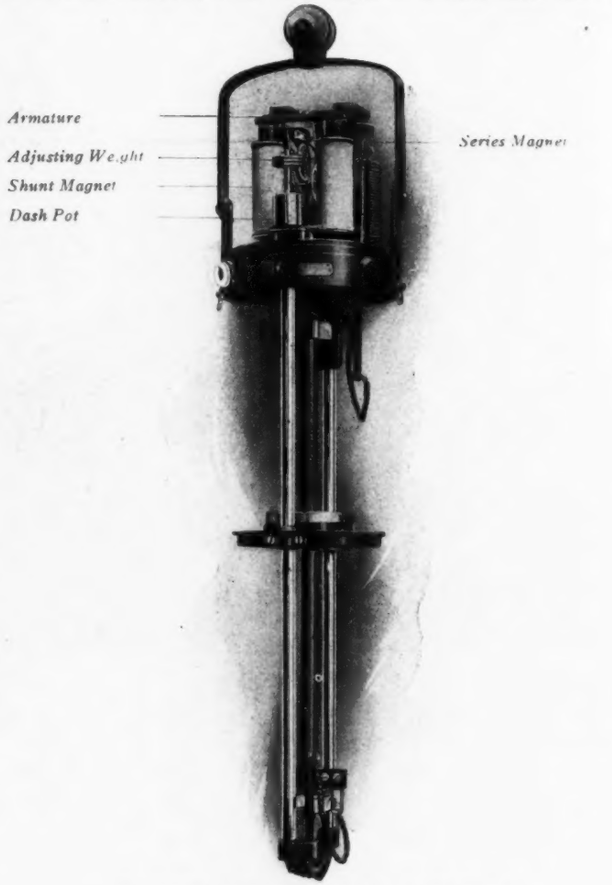


FIG. 1.—DIRECT-CURRENT FLAMING ARC LAMP.

half for the same amperage and number of hours burning. The carbon shell giving mechanical strength to the electrode is 2 mm thick, while the diameter of the core is from 13 mm to 14 mm. The lamps are built for either 30 or 40 volts at the arc so that three or two may be burned in series on a 110-volt circuit. As the maximum light intensity is near the horizontal, the distribution is such as to render the lamp especially suitable for general illumination of streets, railroad sheds, machine shops, etc. The engravings show the mechanism of both lamps

in detail. On an insulated plate sealed against the ingress of fumes are mounted the series and shunt magnet between which is a clockwork mechanism. In the clockwork mechanism is a wheel over which a copper rope runs. To one end of the rope a carbon holder is attached and to the other end a counter-

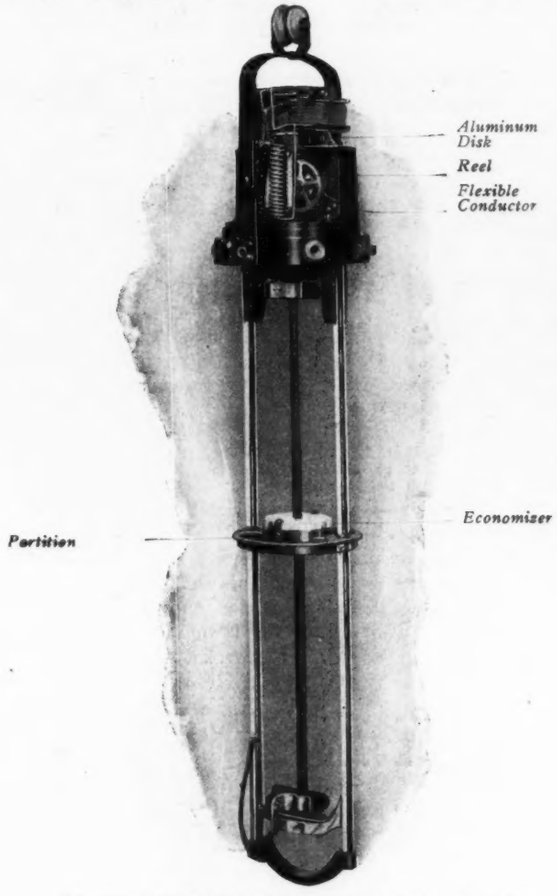


FIG. 2.—ALTERNATING-CURRENT FLAMING ARC LAMP.

weight. The carbon and holder being heavier than the counterweight, seek to turn the wheel, and by means of a ratchet arrangement the carbons are fed gradually, the movement being,

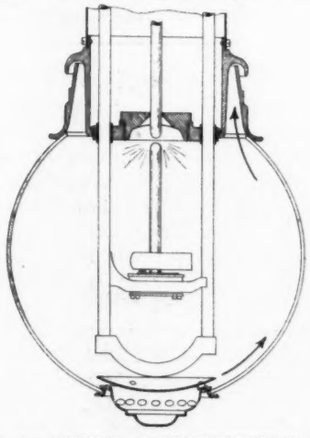


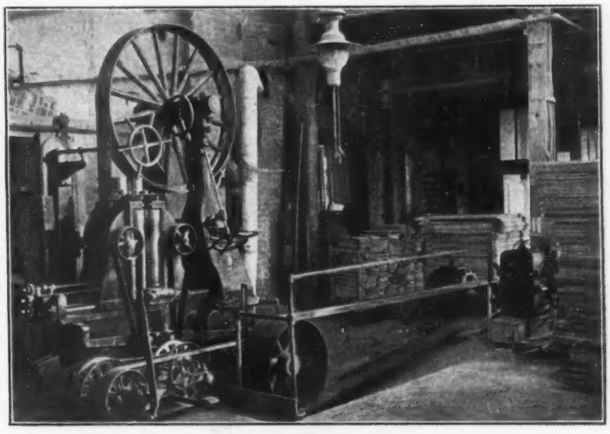
FIG. 3.—METHOD OF VENTILATING GLOBE.

of course, under control of the magnets. The economizer is fixed at about the center of the rods and the electrodes are fed so that the arc remains practically in the one spot.

Motor-Driven Band Saw in Carriage Works.

In the manufacture of automobile bodies use is made of a large amount of poplar ¼ in. or less in thickness and from 12 in. to 36 in. in width. The stock from which the panels are made is usually 1 in. thick and must be resawed in the factory into ¼-in. boards. Many difficulties attend the driving of the resawing machinery by line shafting, but satisfactory results are obtained when use is made of an induction motor for driving each machine.

The accompanying illustration shows a 40-hp Westinghouse

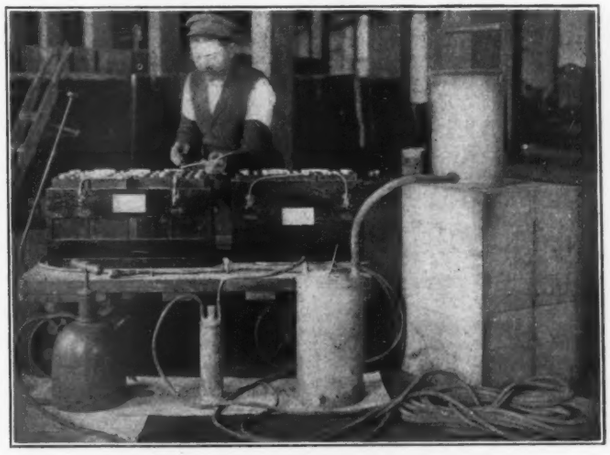


MOTOR-DRIVEN BAND RESAW IN CARRIAGE WORKS.

induction motor belted to a 60-in. American band-type resaw in the plant of the Detroit Carriage Works, at Detroit, Mich. The motor-driven equipment evidently absorbs no power when the machinery is not in use, while the induction motor maintains a constant speed in service and can withstand sudden and severe overloads.

Portable Hydrogen Generator Outfit.

The Electric Storage Battery Company has recently placed on the market a portable hydrogen generator outfit adapted for repair work on storage batteries, and especially for emergency use where lead burning is to be done away from the regular repair shop or battery depot. The complete outfit consists of four principal parts, and is so arranged that when packed for transportation, three of the parts nest inside of each other, forming a compact parcel with a bail handle for carrying, the pump being easily carried by its piston handle. The total weight of the apparatus, exclusive of the pump, is about 46 lb. When set up for use it makes a complete generator quite as serviceable for



PORTABLE HYDROGEN GENERATOR OUTFIT.

temporary use as the larger apparatus manufactured by this company. The generator furnishes gas sufficient to make a suitable flame for lead-burning work for over five hours continuously or more than sufficient time for burning on all connections in a complete set of vehicle cells in trays.

Combination Battery Volt-Ammeter.

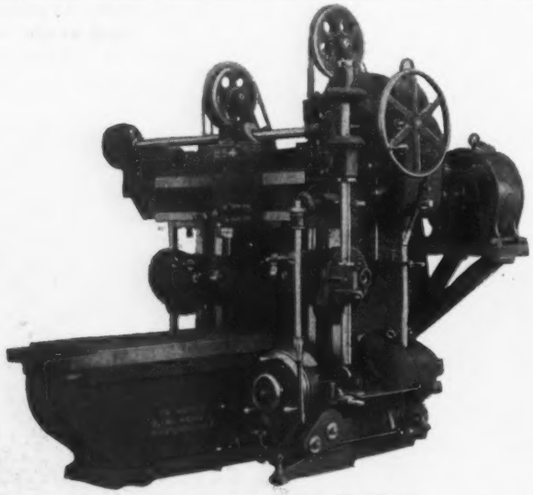
The pocket type instrument illustrated herewith is really two instruments in one. The voltage side is used for testing storage batteries, the e.m.f. of each cell of which, during the charging period, should measure 2.5 volts when each cell is fully charged; when the e.m.f. is below 1.7 volts, the cell should be recharged. A storage cell on open circuit should have an e.m.f.

COMBINED VOLTMETER AND AMMETER.

of from 2.0 to 2.2 volts when fully charged. The ampere side of the meter is used for showing the condition of dry batteries, each cell of which should be tested separately; when the current produced by any cell on short-circuit is less than 6 amp the cell should be replaced by a new one. The above combination meter has been placed on the market by the Connecticut Telephone & Electric Company, Meriden, Conn.

Motor-Driven Milling Machine.

The phenomenal growth of automobile manufacturing in recent years and the special parts to be machined have given rise to the production of the milling machine shown in the accompanying illustration. The tool is made particularly by the Ingersoll Milling Machine Company, and for milling engine

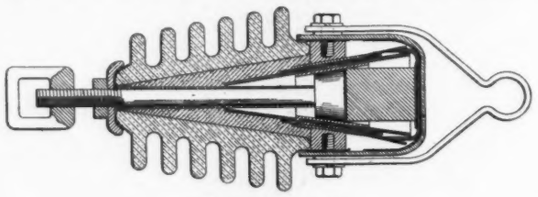


MOTOR-DRIVEN MILLING MACHINE.

bases and transmission cases of automobiles. It is, however, not only adapted for this work, but for any other work which may be machined on either a planer or milling machine. The three spindles have speeds varying from 15 r.p.m. to 120 r.p.m. The speeds are arranged for face mills up to 10 in. in diameter for steel or cast iron, but for aluminum work larger cutters may be used. The machine has a capacity of 26 in. between the ends of the horizontal spindles, and 24 in. between the table and vertical spindle. The motor equipment consists of a 15-hp, direct-current, shunt-wound, Westinghouse motor. The motor is mounted on a bracket in the rear of the machine, where it takes up little space and does not interfere with the work or the operator. The speed changes, from 875 r.p.m. to 1500 r.p.m., are effected by variations in the shunt field by means of a drum-type controller, not shown. In addition to the range of speed thus obtained there are four changes by mechanical means. This enables the cutting speed required by the work to be obtained with exactness and maintained with certainty. In the case of machine tools especially is it desirable to have a perfect control and adjustment of the speed; and undoubtedly the most satisfactory method of obtaining this is by means of the adjustable speed motor and a suitable controller.

Strain Insulator.

With the rapid development of heavy electric railway work there has arisen a demand for efficient strain insulators for catenary work, where the link-type insulators are unapplicable. The existing types of strain insulators, when built for heavy strains and high voltages, become very large, heavy and expensive and some forms lack sufficient reliability. The accompanying illustration shows a new type of strain insulator, patented by J. P. Nikonow, to meet the occasion. In this insulator a mica tube is inserted between conical metal parts of comparatively small size, insuring light weight of the piece. In order to reduce the stress on the mica tubing several metal sheets are interposed between the mica and metal parts. The mica insulation is allowed to extend considerably beyond the metal parts, so as to reduce creeping leakage to a minimum. A



STRAIN INSULATOR.

sheet-metal cap covers the top of the insulator, protecting it from the atmospheric influence, and with the same purpose a removable porcelain bushing is fitted over the insulator. The patent rights of this insulator have been acquired by the Westinghouse Electric & Manufacturing Company.

Insulation for Covering Joints in High-Tension Conductors.

The requisites for a first-class insulation for covering a high-tension joint are permanently high mechanical strength, adhesiveness and dielectric strength and ease of manipulation. The material having these qualities when applied to a wire joint make a protecting covering that reliably maintains the insulation of the joint equal to that afforded by the original covering of the wire. It is claimed that all of the above qualities are possessed by "Neponset splicing compound." In the process of manufacture this compound is rolled to two standard thicknesses of 0.035 in. and 0.048 in., sheeted on glazed muslin and then cut into tape, usually ¾ in. wide. The glazed muslin, by preventing access of air to the compound, prevents surface curing of the latter, and the full adhesiveness is thus preserved. The strip of muslin also protects the turns of the tape from sticking together in the roll. It is said that the compound will withstand a tensile stress of 500 lb. per square inch, and that a single thickness of the 0.035-in. tape will withstand a puncture test of 10,000 volts. It is said that the material does not deteriorate with age, and that no heat is required in its application. This material is manufactured by the Massachusetts Chemical Company, Walpole, Mass.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Although conditions of trade during the past week were somewhat irregular the general tone is better. There is a little more buying done in all of the large wholesale centers. The first of the spring buyers' excursions began during the week and quite a large number of outside merchants have been attracted to the central markets. In both New York and Chicago the dry goods and notion jobbers are reporting a considerable number of orders, although the buying is still characterized by marked conservatism. As a rule reports from these visiting merchants are that their stocks are low but that they do not care to make extensive orders until they are assured that general business has revived. Their presence, however, and their general interest in the market have engendered a distinct feeling of optimism among the wholesalers. In the South and Southwest store trade remains rather quiet and collections are not what merchants would like to have them. In industrial lines the resumption of normal conditions seems to be practically as far off as ever. There is some little growth in almost all directions, but only in cotton goods and textiles is there really enough business to prove distinctly encouraging. Cottons are now being sold for October delivery, but outside of this line very few future orders are being placed. Heavy storms and unsettled weather conditions throughout the West have done much during the past week to retard traffic, and also have kept customers out of the retail market. In the metal line prices continue to sag and business is very dull. Sales of pig-iron are scarce and but few orders for finished material are being recorded. There is some activity in cast-iron pipe as many municipalities are extending and rebuilding their water system. The demand for steel rails continues to be very light and orders that were expected to come early in 1909 have not as yet materialized. The Baltimore & Ohio Railroad placed an order during the past week of considerable size, but it was parceled out among so many producers that it amounted to very little to any one of them. The demand for electrical goods, it is said, has declined. The trade in brass is worse than it was a few weeks ago and the sheet copper concerns are running far below their normal capacity. Business failures for the week ended Feb. 10 were 211 against 286 the previous week, 326 for the like week in 1908, 204 in 1907, 208 in 1906 and 243 in 1905.

THE COPPER MARKET.

The first report of the Copper Producers' Association, which was made public during the past week, showing a surplus in this country of "marketable copper" of 144,000,000 lb., has done much to hold the price of copper steady and to strengthen the prices of copper company stocks. While the figures were in excess of the public's guess as to what they would be, they were so much below the private estimates of copper surplus that there is a disposition to receive them with incredulity. The term "marketable copper," it is understood, includes neither pig copper—of which 30,000,000 lb. were exported last year—nor does it include any copper in process of refining. According to this report the production of copper during the month of January was 112,000,000 lb. and the amount delivered for consumption and export was 90,000,000 lb. Here there is an admission that the surplus has increased since Jan. 1 at least 22,000,000 lb. Add this to the government's estimate of the surplus on that date, 213,000,000 lb., and we would have at the time the producers' report was made 235,000,000 lb. surplus instead of 144,000,000 lb. This is quite a remarkable difference, and is all the more striking when it is remembered that both sets of figures were compiled by the same statistician—Mr. L. C. Graton. To figure it in a different way: From the producers' report it is evident that the consumption and exports of copper for January amounted to about 80 per cent of the production and imports; applying the same percentage for the year to the production, which is figured at 1,123,000,000 lb., and we have an accumulation for the year of 224,000,000 lb. These figures, however, are misleading. The exports of copper are known to have been slightly in excess of 650,000,000 lb. and the takings for domestic consumption, according to the most liberal estimates, about 400,000,000 lb. The sum of these deducted from the production for the year would leave a surplus for the year of 73,000,000 lb. to be added to the surplus of 123,000,000 lb. in January, 1908—more than the producers' figures and less than government figures. All of these figures are referred to in order to show that in spite of official and private statisticians, we are in practical ignorance of the condition of the copper industry. This condition is referred to by Mr. J. H. Dewhurst, a staff correspondent of the London *Morning Post*, who recently visited this country for the purpose of investigating copper. "It is wholly impossible at this time to publish exact figures," he says. He also has this to say concerning the New York market: "New York quotations are artificial. The large metal-selling companies and their customers are reticent as to prices of actual sales, but it is an open secret that a system of rebates quoting 2 cents a pound below published figures is in operation." During the past week in the New York market sales of actual copper have been light, but there has not been upon the surface any disposition to shade prices. The sales that are made are mostly in small quantities and have the appearance of orders to fill immediate necessities. The exports for February up to and including Feb. 15 have been 6761 tons. Prices quoted on the Metal Exchange were:

Lake	13½ @ 13⅝
Electrolytic	13 @ 13¼
Casting	12⅞ @ 13⅛

London quotations were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	58 12 6	58 7 6
Standard copper, futures	59 2 6	59 5 0
Market	Easy.	Steady.
Sales of spot		600 tons
Sales of futures		800 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	13.55
Electrolytic	14.25	13.12½
Casting	14.12½	13.00
London, spot	£64 2 6	£57 7 6
London, futures	64 17 6	58 7 6
London, best selected	67 15 0	61 15 0

EXTENSIVE NERNST LAMP INSTALLATION.—The Nernst Lamp Company has contracted with McFadden Brothers, proprietors of one of the largest department stores in Wheeling, W. Va., for Westinghouse Nernst lamps to light their new building. The new building, which the firm is now moving into, is a modern fireproof structure of steel, brick and stone. It consists of three floors and basement, all of which will be lighted by single glower Westinghouse Nernst lamps in special three-arm fixtures.

CANADIAN LIGHT COMPANIES FOR SALE.—Announcement is made by E. R. C. Clarkson, 33 Scott Street, Toronto, that he will receive tenders up to March 4 for the entire capital stock, save a few shares, of the Oshawa Electric Light Company, owning steam and water power plants in the town of Oshawa, Ont. This company also owns the property of the Bowmanville (Ont.) Electric Light Company, owning both a steam and water power plant and a transmission line in Bowmanville.

RUSH TO EQUIP WITH WIRELESS.—It seems likely that before the bill which has just been favorably reported in Congress can become a law a majority of the ocean-going ships will be equipped with wireless. There is at the present time a great rush in this direction. A representative of the United Wireless Telegraph Company says: "We are almost swamped with orders from steamships. Our factory is running overtime trying to keep up with its orders."

HISTORY OF COPPER PRICES.—The Wire & Telephone Company of America, manufacturer of electric wires at Rome, N. Y., has issued its regular annual leaflet "Copper History," which shows the monthly and yearly average prices of copper from 1883 to 1909. The publication makes convenient reference data for any one interested in the copper market.

SALES OF ALLIS-CHALMERS TURBINES.—Among some of the large steam-turbine generating units which have recently been contracted for from the Allis-Chalmers Company are the Memphis Consolidated Gas & Electric Company, two additional units of 1500 kw each to be added to a similar generator which was put in operation some time ago; the Pacific Mills, at Lawrence, Mass., a unit rated at 3250 kw to supplement the present plant, and the Pfister & Vogel Leather Company, of Milwaukee, two units of 1500 kw each. The Golden State Portland Cement Company, Oro Grande, Cal., and F. W. Bird & Son, paper manufacturers, East Walpole, Mass., have each purchased units of 750 kw. Among those now installing machines of 500 to 1500 kw are the city of Dunkirk, N. Y.; Cedar Rapids & Iowa City Railway & Light Company; Evansville Terminal Railways; Willamette Valley Company, Eugene, Wash.; Webster & Southbridge Gas & Electric Company, Webster, Mass.; Citizens' Electric Illuminating Company, Pittston, Pa.; Tremont & Suffolk Mills, Lowell, Mass., and United States Reclamation Service, Williston, N. D. The purchases recently made also include, in nearly every instance, auxiliary steam and electrical equipment, such as condensers, steam and motor-driven exciter sets, transformers, switchboards, motors, etc.

GENERAL ELECTRIC'S SALES IN 1908.—Unofficial figures concerning the General Electric Company's business billed in 1908 indicate it will be about $40,000,000. During the last quarter of the past year the sales of the company were about $13,000,000, and this was much the best quarter of the year. During January the company billed about $6,000,000 in orders, and if this should continue during the coming year, 1909 would be very satisfactory. It is not expected, however, that this rate can be maintained in the present condition of business. The big rush in January is explained by the fact that it is the last month of the company's fiscal year, and an especial effort is made to hurry in orders at that time. The business billed during the year which ended Jan. 31, 1908, was slightly more than $70,000,000, and for the year previous about $60,000,000, so that the past year is in the neighborhood of 60 per cent of the average for the past two years. The company is in an exceptionally strong financial condition having on hand a cash balance of $21,000,000. There is no likelihood of its dividend being curtailed even if the entire amount necessary for its payment has not been earned.

MOTORS FOR PNEUMATIC SERVICE.—The opening of the new station "H" Post-Office at Forty-fifth Street and Lexington Avenue, New York City, adds another to the numerous power stations of the Pneumatic Service Company which have recently been fitted with motors. In this station three motors have been installed: one of 75 hp, one of 40 hp and one of 30 hp. The Pneumatic Service Company has within the past year made a number of installations of motors for the purpose of driving its reciprocating and rotary compressors. They use direct current supplied by the New York Edison Company. The power installations of the company in addition to the new station are: At the General Post-Office two 75-hp and one 30-hp; at station "O," one 105-hp, one 75-hp, one 65-hp; at Times Square station, two 105-hp, one 60-hp, one 30-hp; at station "W," two 105-hp, one 80-hp; at station "J," one 70-hp, one 65-hp, one 50-hp. The plans for the new post-office building to be erected at the Pennsylvania Railroad terminal have not yet been made. The New York Pneumatic Service Company is now operating in Manhattan and Brooklyn 21 miles of double-tube line.

CHICAGO NORTH SHORE RAILWAYS TO INCREASE ITS POWER EQUIPMENT.—The North Shore Electric Company has closed a contract with the receivers of the Chicago & Milwaukee Electric Railroad Company by which it will supply 1000 kw of 25-cycle alternating current power to the railway at Waukegan, Ill. The railway is already taking a like amount from the central station company at Evanston, Ill. Owing to this order and the general expansion of the business, the North Shore company will increase the equipment of its Waukegan generating station by installing a 2500-kw Curtis 9000-volt 25-cycle turbo-generator, Babcock & Wilcox boilers, Worthington condensing apparatus and the necessary switchboard extension. Orders have been placed for this material. In the Waukegan station two turbines are now in operation, one of 500 kw and another of 1000 kw.

ELECTRICAL GOODS FOR THE FAR EAST.—The Bureau of Manufactures, of the Department of Commerce and Labor, has received information from an American consul in the Far East of opportunities for the sale of electrical machinery. Full information as to the location and names of the companies interested can be secured from the chief of the bureau. The consul says that the local branch of a house whose main offices are in France contemplates putting in an electric railway line between two cities in his district, and will soon be in the market for supplies. He also says that there is some dissatisfaction with the electric light service because of the poor material employed, and a market could be found for a superior grade of electrical fixtures, such as lamps, fans, brackets, bells and the larger parts of the electrical equipment.

WESTINGHOUSE CONDENSER INSTALLATIONS.—The Westinghouse Electric & Manufacturing Company reports that its American adaptation of the type of condenser which has been popular in Europe is meeting with marked success in this country, mostly in connection with new turbine equipments. The Narragansett Electric Light Company, of Providence, R. I., is installing two units of 7000 hp in connection with new turbines; the B. F. Goodrich Rubber Company, Akron, Ohio, has ordered one unit for its central power plant; the Coronet Phosphate Company, Plant City, Fla., three units; Portland Cement Company, Trinidad, Col., one unit, and city of Logansport, Ind., one unit.

LAYING THE GERMAN BRAZILIAN CABLE.—United States Consul Solomon Berliner, of Teneriffe, reports that the German-Brazilian Cable Company has already begun work on its line between Emden and Teneriffe. This first section will be 2163 nautical miles in length. It has not yet been decided if the cable will then be laid direct from Teneriffe to Pernambuco, Brazil, or if it will be connected with Monrovia, Liberia. The length of the second section would be 2766 miles in the first case and 3800 miles in the second, but the latter is considered more advantageous, as the cable, if connected with Monrovia, would serve the German colonies in Southwest Africa.

OPPORTUNITY TO SELL HYDRO-ELECTRIC MACHINERY.—The Bureau of Manufactures of the Department of Commerce reports that an American consul has sent to it information that two gold dredging companies in his district are preparing to construct jointly a hydro-electric plant having a capacity of 15,000 hp. The electrical energy generated in the plant will be used to operate dredges, elevators, hoists, railways, tramways, lamps and telephones. Information concerning the proposed plant can be obtained from the chief of the bureau.

ANOTHER MODEL STEEL CITY.—The United States Steel Corporation, it is said, is preparing plans to build another great plant and model city like Gary, Ind. It will be located on both sides of the St. Louis River, three miles from Superior, Wis. The plant is expected to cost $14,500,000. The blast furnaces are to be located on the Minnesota side of the river, but auxiliary plants are to be located on the Wisconsin side. The Steel Corporation has purchased and cleared 1600 acres of land on the Wisconsin side.

ELECTRICAL GOODS IN CENTRAL AMERICA.—Mr. Stephen J. Burke writes from Belize, British Honduras, announcing that he proposes opening offices in the City of Mexico to introduce and push the sale of American electrical machinery and appliances in Mexico and the Central American states. He asks that manufacturers desiring representation in these countries communicate with him.

SAN DOMINGO TELEGRAPH TOLLS REDUCED.—The French Cable & Telegraph Company, which controls the telegraph lines in the Dominican republic, has reduced its tolls to an average rate of 5 cents per word between any points on the island. Formerly some of the rates were as high as 20 cents per word.

Financial Intelligence.

THE WEEK IN WALL STREET.

The condition of trading on the New York Stock Exchange during the past week was about as near absolute stagnation as can be imagined. The average for the four days which ended with Feb. 11 was less than 400,000 shares per day. For this situation there seem to be a number of reasons, but the main one is, of course, the absolute lack of interest in business which almost all industrial and commercial lines are now showing. It is generally believed that the industries, especially the metal trades, are simply waiting for a decision in the tariff matter.

This state of uncertainty prevents new orders from being placed and establishes strict conservatism in every branch of commercial activity. It is asserted, and probably with much truth, that the steel and iron companies are only operating at the present time upon orders which were received last fall. New orders are few and far between and when they do appear are mainly for the purpose of filling in absolute necessities. Unless there is a change for the better very speedily, it is predicted that even the present limited operation of the steel mills will have to be curtailed. What trading there is on the Street is done by small professionals and floor traders. This, of course, means no business to the commission houses and indicates that the outside public is almost entirely absent from the market. One of the interesting features during the past week was the first report of the Copper Producers' Association. This report was distinctly encouraging as the figures it gave out of the surplus amount on hand were not more than 60 per cent of what had been estimated by statisticians during the past few months. The effect upon the copper stocks was a moderate advance and the strength in these issues was sufficient to hold the entire market very firm. As a matter of fact, the net changes for the week were mostly slight advances and the tone on Feb. 15 was strong and upward. The decision of the Public Service Commission, Second District, in permitting the Erie Railroad to issue $30,000,000 worth of bonds lost much of the favorable effect it would otherwise have had by the rather drastic conditions which were placed about the issue and the further fact that the favorable decision was only reached by a vote of three to two of the commissioners. The long investigation which the commission made and the rigid terms which it imposed are not considered to be encouraging to those public utilities which have the further issue of bonds in mind. It begins to look as if the good old days when such corporations could issue all the bonds they wanted to without question had forever departed. The money market continues to be more or less easy and every bond issue that is advertised is quickly oversubscribed. The Chicago Railways issue of $6,000,000 was spoken for many times over before the day that the bids were open. This greediness for bonds shows that there is plenty of money ready for investment or for business. The fact that it is lying in the banks unemployed shows to what extent the recent period of depression has educated the public in conservatism. Foreign money markets are easy and the Continental banks continue to accumulate gold. Money in New York on Feb. 15 was quoted for call loans 2 @ 2½ per cent, for 90-day paper 2¾ @ 3 per cent. The quotations in the table are those of the close Feb. 15.

NEW YORK.

	Feb. 8.	Feb. 15.	Shares sold.		Feb. 8.	Feb. 15.	Shares sold.
All.-Ch.	14⅞	15¼	2,300	Int.-Met., pfd.	43	44¼	20,725
All.-Ch., pfd.	47½	48⅞	2,725	Mackay Cos.	72	72	100
Amal. Cop.	75¾	76⅞	86,025	Mackay Cos., pfd.	71½*	72*	300
Am. D. T.	35*	35*	——	Manhattan Elev.	149*	148½*	200
Am. Loc.	55⅞	57	2,450	Met. St. Ry.	31*	30	10
Am. Loc., pfd.	111¾	112	300	N.Y. & N.J. Tel.	114½	115	320
Am. Tel. & Cbl.	75½*	78	50	Steel, com.	52⅜	53⅛	74,300
Am. T. & T.	128	129⅜	6,430	Steel, pfd.	113⅛	114⅛	6,105
B. R. T.	71½	72⅜	29,991	W. U. T.	67½	68	200
Gen. Elec.	155¼	158	5,200	West'h., com.	80	83	6,500
Int.-Met., com.	15⅝	16¼	19,385	West'h., pfd.	118	118*	100

PHILADELPHIA.

	Feb. 8.	Feb. 15.	Shares sold.		Feb. 8.	Feb. 15.	Shares sold.
Am. Rys.	45*	40½	——	Phila. Elec.	12	12	——
Elec. Co. of A.	11⅛	11½	——	Phila. R. T.	27⅜	28¼	——
Elec. Stor. B'ty.	44½	46¼	——	Phila. Traction.	93¼	93	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	53½	53¾	——

CHICAGO.

	Feb. 8.	Feb. 15.	Shares sold.		Feb. 8.	Feb. 15.	Shares sold.
Chi. City Ry.	180*	187	——	Chi. Tel. Co.	129	130⅝	——
Chi. Rys., Ser. 1.	116*	112½	——	Met. El., com.	17*	17*	——
Chi. Rys., Ser. 2.	44	44¼	——	Nat'nal Carbon.	84*	84	——
Com. Edison	108	108	——	Nat. Carb., pfd.	110*	110*	——
Chi. Subway	26	26*	——				

BOSTON.

	Feb. 8.	Feb. 15.	Shares sold.		Feb. 8.	Feb. 15.	Shares sold.
Am. Tel. & Tel.	128⅛	129¼	——	Mex. Tel.	2¼	2½	——
Com. Tel.	125*	125*	——	Mex. Tel., pfd.	5½	5½*	——
Edison El. Ill.	250	251	——	N. E. Tel.	131	131	——
Gen. Elec.	154½	157½	——	W. Tel. & Tel.	8*	7¼	——
Mass. Elec. Ry.	13¼	14¾	——	W. T. & T., pfd.	79*	79*	——
Mass. E. R., pfd.	65¾	65¾*	——				

*Last price quoted.
Shares sold are for four days, Feb. 8 to Feb. 11.

DIVIDENDS.

Columbus (Ohio) Railway Company, quarterly, 1¼ per cent, payable March 1.

People's Gas Light & Coke Company, Chicago, quarterly, 1¾ per cent, payable May 25.

Sloss-Sheffield Steel & Iron Company, quarterly, 1¼ per cent, payable March 1.

Kings County (N. Y.) Electric Light Company, quarterly, 2 per cent, payable March 1.

American Railways Company, Philadelphia, quarterly, 1½ per cent, payable March 15.

United Railroads, San Francisco, first preferred, semi-annual, 3½ per cent, payable March 15.

Northern Texas Electric Company, Fort Worth, Tex., preferred, semi-annual, 3 per cent, payable March 1.

PROFIT IN GAS AT REDUCED RATE.—The report of the People's Gas Light & Coke Company, of Chicago, shows an increase in the gross earnings of the company for 1908 of $592,600. The surplus for the year after paying all fixed charges, taxes, etc., amounts to $2,755,694, which is equivalent to 8.36 per cent. This surplus is shown after a liberal charge has been made for depreciation, reserve funds, etc. This is the third year the company has shown a comfortable surplus since the Council forced a reduction in the rate to 85 cents per thousand feet in 1906. The record of the company since the cheapening of the rate is taken as a proof that a gas company can earn an adequate dividend even when the rate is lowered. The dividend rate of the company will be advanced at once from 6 to 7 per cent.

SUMMIT COUNTY (COL.) POWER COMPANY BONDS.—Eglinton, Hammond & Andrews, New York City, are offering an issue of $500,000 20-year 6 per cent bonds of the Summit County Power Company. The company has a hydroelectric plant near Dillon, Col., with two 500-kw turbine generators. It is supplying the mining camps of Argentine, Breckenridge, Montezuma, Kokomo and French Gulch within a 20-mile radius. The plant was put in operation last October and already has contracts for power netting $40,000 a year revenue. Its rates for power range from $80 to $100 per year per horse-power. Henry L. Doherty & Company, of New York, have thoroughly examined this property and have taken extensive financial interest in the company.

HUDSON & MANHATTAN RAILROAD EXTENSION.—The Hudson & Manhattan Railroad Company, which has in operation two tubes under the Hudson from New York City to Hoboken and which is building two others to Jersey City, has applied to the Public Service Commission, First District, for permission to extend its Sixth Avenue line from the proposed terminal to the Grand Central station at Forty-second Street and Park Avenue. The plan is to build the line under Sixth Avenue to Bryant Park, diagonally under the park to a point near Fifth Avenue, thence under the present subway to the Grand Central. It is estimated that the extension will cost $5,000,000. The Public Service Commission has not as yet acted upon the application.

CHICAGO RAILWAYS BONDS OVERSUBSCRIBED.—N. W. Harris & Company and the National City Bank of New York had no trouble in disposing of the $6,000,000 worth of new bonds of the Chicago Railways Company. These bonds were 5 per cent first mortgage gold bonds and were very largely oversubscribed before the underwriters opened their bids. With this issue the Chicago Railways Company has $14,000,000 outstanding. Expenditures approximating $12,000,000 are contemplated within the coming year for rehabilitation purposes, so that it is probable that another issue of $6,000,000 will be offered to the public some time during the summer.

MEXICAN LIGHT & POWER COMPANY.—Whether the deal by which the Mexico Tramways Company takes over the Mexican Light & Power Company is finally ratified or not it is promised that the plans of the latter company for increasing its capacity will be carried through. By the construction of about 20 miles of canals and tunnels bringing into use the water from rivers now untouched it is expected that the capacity of the present plant will be increased from 50,000 hp to 124,000 hp. With these improvements and extensions the company will be able to furnish light and power for the greater part of the Federal district.

CHICAGO & OAK PARK ELEVATED.—Arrangements have been made by the Chicago & Oak Park Elevated Railroad Company through Blair & Company, New York, to secure $1,000,000 to elevate the line in Oak Park and to build an extension to Humboldt Park.

NEW YORK EDISON EARNING POWER.—The annual meeting of the New York Edison Company, which was held Feb. 9, resulted in the re-election of the old directors and a continuation of the present management. There was no financial statement given out at all, but a few shares of the $45,051,000 capital stock are owned by the Consolidated Gas Company. The only information concerning the financial operations of the Edison company are to be obtained from the figures submitted to the Public Service Commission. These go so extensively into detail that the actual earnings of the company are hard to determine. These figures show, however, that in the year 1907 the company manufactured and delivered energy for lighting and power at an average cost of 4.69 cents per kw-hour. This charge included all costs, taxes and fixed charges. The company received from the sale of this current an average price of 6.49 cents, leaving a net profit per kilowatt of 1.80 cents. As the number of kilowatt-hours sold to the public was 209,024,000 there would appear to have been a profit on the year's sale of $3,762,432. This is equal to 8.3 per cent on the entire capital stock. The earnings for 1908 are largely a matter of conjecture, but it is known that in spite of the generally depressed condition of business the New York Edison Company made large gains over the previous year. During the year 1908, as already noted on these pages, 34,831 new contracts were made for the supply of electrical energy, aggregating an equivalent of 2,765,616 incandescent lamps of 16 cp. The net increase for the year was 882,939 in such lamp units. This is an increase of 14.9 per cent over the previous year in the volume of business.

STANISLAUS HYDRO-ELECTRIC PLANT SOLD.—In spite of the protest which was made by a few of the bondholders of the Stanislaus Electric Power Company against the sale of that property to the United Railroads of San Francisco, the deal has been consummated and the contract signed. The opposition, it is said, only represented a few bondholders and is stated to have been more political than financial. The United Railways Investment Company, the holding company of the street railway property in San Francisco, is ostensibly the purchaser of the power company. On the part of the Stanislaus company it was managed by a bondholders' protective committee, at the head of which was Mr. S. Z. Mitchell, president of the Electric Bond & Share Company, of New York, which company is a subsidiary of the General Electric Company. It is proposed under the terms of the deal that the present $6,000,000 issue of first mortgage bonds of the Stanislaus company shall be surrendered in exchange for second mortgage 40-year 5 per cent bonds non-foreclosable before July 1, 1914. All of the stock of the reorganized Stanislaus company is to go to the United Railways Investment Company in exchange for $900,000 of preferred stock and $900,000 of common stock at par. It is further proposed to issue $5,500,000 of first mortgage Stanislaus bonds to complete the work of developing the hydro-electric property and to issue not more than $1,000,000 additional bonds to develop the distributing system. The contract with the traction company is that energy shall be supplied for a term of 44 years at 7.5 mills per kw-hour. The new power company will have a peak capacity of 48,000 kw under the present plans.

GERMAN ELECTRIC TRUST.—Following the denial, which has been already published, of the report that the price agreement between the principal German electrical manufacturers would be broken up there comes the following information from Mr. Richard Guenther, consul-general at Frankfort, of the formation of a large trust company for the purpose of financing electrical enterprises. The consul says: "A new financial movement of great importance and far-reaching influence has been inaugurated in Germany by the creation of an electric trust company at Berlin by the Allgemeine Elektricitats Gesellschaft, the Siemens & Halske and the Siemens-Schuckert Works. The share capital of this new finance company is to be 30,000,000 marks ($7,140,000), besides which 90,000,000 marks of bonds are to be issued by it. The aim is to supply funds to parties (private or municipal) contemplating the erection or extension of electric plants, to loan money on electric works, etc., provided ample security is rendered by the applicants. A similar trust company is announced as being projected by the Felton & Guilleaume-Lahmeyer Electrical Combination. In Vienna one of the great Austrian banks has combined with the principal electrical company for a like purpose, viz., to promote electrical manufacturing interests by financial aid without directly involving these, as was the case heretofore when the electric companies undertook huge enterprises not having any solid basis at their own risk or gave extensive credit to speculating promoters."

MACKAY COMPANIES TO MAINTAIN CABLE RATES.—At the anual meeting of the Mackay Companies, the holding corporation of the Postal Telegraph and Commercial Cable Companies, the old directors were re-elected. The corporation is also the largest stockholder in the American Telephone & Telegraph Company. The financial report shows that the total income from investments in subsidiary companies, for the year ended Jan. 31, 1909, was $3,685,761. Out of this the regular 4 per cent dividend on both the common and preferred stock was paid, leaving after the expense of the year had been deducted a balance of $5,518. While the detailed reports of the telegraph and cable companies are not made public the report shows that there was a decrease in the cable company's earnings last year owing to the damage to its lines done by steam travelers off the coast of Ireland. The report quotes the letter of General Manager Ward, of the cable company, written to the New York Board of Trade & Transporation and heretofore summarized in the *Electrical World*, protesting against any reduction in cable rates. The latter argues that 25 cents per word is necessary to give the company an adequate return. Mr. Ward says that the Commercial Cable is in no rate combine with other companies, but that it will not reduce its present tolls. The cost of the New York-Havana cable and the subscription to the new stock of the American Telephone & Telegraph Company were paid for out of the earnings of the company during the year.

UNITED ELECTRIC LIGHT & POWER COMPANY.—No financial statement of the United Electric Light & Power Company, of New York City, was made at the annual meeting of that company, but it was given out in a general way that the business of the year had been very satisfactory and the promise for the future was very encouraging. The company furnishes, exclusively, the Washington Heights section of the city, where very rapid development is in progress. At present the company has in sight new contracts, approximately 50,000-cp equivalent. There are some 35 apartment houses included in this business, the greater part of which are to be equipped with elevators of the two-phase type, and where the public halls and the individual apartments are wired throughout. It is estimated that the United company has in sight new business that represents practically 10 per cent of its present connected 16-cp equivalent.

PLANS FOR CONSOLIDATING CHICAGO ELEVATED ROADS.—A committee consisting of Messrs. Ira M. Cobe, vice-president of the Assets Realization Company, Samuel Insull, president of the Commonwealth Edison Company, and Emile K. Boisot, vice-president of the First Trust and Savings Bank, all of Chicago, have been named to work out a plan for the consolidation of the three elevated traction companies of that city. It is said that the Northwestern Elevated will probably be designated as the lessee corporation which will take over and operate the South Side and Metropolitan companies if satisfactory terms can be agreed upon. In the event that this deal is carried out the Northwestern company will absorb the Chicago & Oak Park Elevated Company.

NEW WIRELESS COMPANY ORGANIZED.—Plans are on foot for the organization of the Wireless Company of America by a number of Brooklyn financiers. Among these is Mr. P. M. Smith, a member of the firm of Clarence M. Smith & Company, of 64 Wall Street. In speaking of the plans of the new company Mr. Smith said: "Our authorized capital stock will be $10,000,000—and while we are not ready as yet to announce the personnel of the company, you may say that it will be financed by private Brooklyn capital and the stock will not be offered to the public. As soon as a proper site in Brooklyn can be secured a large tower will be erected for experimental purposes. We expect to bring new features into the wireless field."

CAPITOL TRACTION COMPANY'S PROSPEROUS YEAR.—The report of the Capitol Traction Company, of Washington, D. C., shows gross earnings of $1,841,171 for the year 1908 compared to $1,764,345 in 1907. The operating expenses, however, were largely reduced and the net earnings were $1,062,833, as against $883,027 in 1907. After paying all fixed charges, taxes and rentals there was left a surplus for the year of $771,886 applicable for dividends.

STONE & WEBSTER COMPANIES' EARNINGS.—The Stone & Webster Corporation, of Boston, has issued a combined statement of all the traction, electric light, power, gas and water power companies, under its management for the year 1908. There are 28 companies comprised in the figures which show the following: Combined capitalization: bonds and coupon notes outstanding, $57,779,900; preferred, capital and common stocks outstanding, $55,825,220; total, $113,605,120. Total earnings and expenses 1908: Gross earnings, $17,328,336; operating expenses, $10,276,654; net earnings, $7,051,682; interest charges including taxes, $4,115,895; balance, $2,935,787; dividends paid, $1,489,275; balance, $1,446,512. Total disbursements for the year 1908 for interest on bonds, coupon notes and dividends on stocks, $4,255,775; miles of equivalent single track operated, 934; passengers carried, 236,358,367; total connected electric lighting load equivalent to 1,443,914 16-cp lamps; total commercial power load, approximately, 67,187 hp; total combined power station capacity, approximately, 162,914 hp, of which 52,825 hp is generated by water power.

AMERICAN SMELTING & REFINING EARNINGS.—The American Smelting & Refining Company has issued a statement covering its operation for the six months ended Oct. 31, 1908. This is for the first six months of the company's fiscal year which ends on April 30. The net earnings from operations for the period covered were $3,917,683, and the balance which was applicable to dividends was $3,841,760. Out of this was paid the 3½ per cent semi-annual dividend on the preferred stock, and a dividend on the common stock amounting to 2 per cent. The total assets of the company are estimated at $117,802,183. The total surplus of the company now amounts to $14,499,979. The total value of the refined metals which the company sells annually is estimated to be $97,000,000.

HUDSON COMPANIES BONDS OFFERED.—Harvey Fisk & Sons, of New York City, are offering to the public at par with accrued interest $1,500,000 of the Hudson Companies 6 per cent secured convertible gold notes. These notes are secured by deposit with the Standard Trust Company, as trustee of the Hudson & Manhattan Railroad Company's first mortgage 4½ per cent convertible gold bonds, due 1957, at the rate of $1,500 per value of bonds for each $1,000 of notes outstanding. Holders of the notes have the privilege of receiving in payment of prinicpal at maturity or on redemption prior to that date either cash or an equivalent amount of Hudson & Manhattan Railroad Company first mortgage bonds, figured at 85 per cent of the par value of the bonds, with accrued interest.

UNITED RAILROADS OF SAN FRANCISCO.—The annual report of the United Railroads of San Francisco shows that the earnings of the road are increasing and that it is beginning to earn dividends on its cumulative issues of stock. The property is owned by the United Railways Investment Company, which has outstanding $19,400,000 common stock and $15,000,000 5 per cent cumulative preferred stock. The United Railroads Company has outstanding $20,000,000 common stock, $20,000,000 4 per cent cumulative preferred and $5,000,000 7 per cent cumulative first preferred stock. The dividend of 3½ per cent just declared is the initial semi-annual declaration on the last named issue, which was sold a little over a year ago.

TELEGRAPH COMPANIES INCREASE CAPITAL.—Two of the Mexican and Central American telegraph companies have recently authorized increases in their capitalization. At a special meeting of its stockholders the Central & South American Telegraph Company has authorized an increase of its capital stock from $12,000,000 to $14,000,000. The Mexican Telegraph Company also authorized an increase in its capital stock from $3,000,000 to $5,000,000. No arrangements have been made by either company to issue new stock at present and the stock will not be issued until the expenditures from net earnings justify the directors in selling the new stock.

NEW YORK, WESTCHESTER & BOSTON.—The Public Service Commission of the Second District of New York has granted full permission to the New York, Westchester & Boston Railway Company to go ahead with its construction work. The company had already received its certificate from the Public Service Commission of the First District. This step practically relieves the proposed rapid transit line—which belongs now to the New York, New Haven & Hartford Railroad Company—of all legal disabilities so far as construction is concerned and it is said that active work will begin as soon as the weather permits.

BROOKLYN UNION GAS COMPANY.—Notices have been sent out by the Brooklyn Union Gas Company that the 6 per cent convertible debentures of the company, which mature on March 1, will be exchanged at par for shares of the capital stock of the company at par, if presented for exchange on March 1, in accordance with the terms of the debentures. These debentures should be presented to the Guaranty Trust Company of New York. The stock certificates to be issued in exchange will be dated March 1, 1909, and delivered as soon after that date as possible.

CHESAPEAKE & POTOMAC TELEPHONE COMPANY.—The annual report of the Chesapeake & Potomac Telephone Company, of Washington, D. C., makes an excellent report of its 1908 business. The gross receipts for the year were $1,180,384; the total expenses, including fixed charges and dividends, were $1,056,723, leaving a net surplus of $123,661. The business during the year showed considerable expansion. More than $650,000 was spent for new construction and equipment.

COMMONWEALTH EDISON SECURITIES LISTED.—The Commonwealth Edison Company has had listed upon the Chicago Stock Exchange $30,000,000 of stock, $8,000,000 Commonwealth Electric 5 per cent bonds and $10,000,000 Commonwealth Edison 5 per cent bonds. In filing the application for this listing the company's report stated that its physical property was appraised at $52,495,749.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Central District & Printing Telegraph Company, Pittsburg:					
Year 1908	$4,445,734	$3,251,234	$1,194,500	$58,992	$1,135,508
Year 1907	4,386,496	3,273,613	1,112,883	59,480	1,053,403
Chicago Telephone Company:					
Year 1908	8,741,517	6,668,176	2,073,341	.....	.....
Year 1907	8,718,951	6,976,868	1,742,083	.....	.....
Cumberland Telephone & Telegraph Company, Nashville, Tenn.:					
Year 1908	6,141,817	3,662,972	2,478,845	485,415	1,993,430
Year 1907	5,917,273	3,642,634	2,274,639	521,950	1,752,689
Dallas (Tex.) Electric Corporation:					
Year 1908	1,169,967	780,655	389,312	308,625	81,287
Year 1907	1,125,673	760,743	364,930	280,467	84,463
Massachusetts Lighting Companies:					
Year 1908	751,750	494,621	257,129	85,546	171,583
Year 1907	439,777	275,151	164,626	61,721	102,905
Minneapolis (Minn.) General Electric Company:					
Year 1908	1,008,415	432,929	575,486	382,000	193,486
Year 1907	920,506	428,359	492,147	297,680	194,467
Nashville (Tenn.) Railway & Light Company:					
Year 1908	1,597,029	954,296	642,733	393,099	249,633
Year 1907	1,578,207	969,104	609,102	353,902	254,200
Nebraska Telephone Company, Omaha, Neb.:					
Year 1908	1,852,191	1,372,693	479,498	.....	.....
Year 1907	7,773,166	1,344,622	428,544	.....	.....
Northern Texas Electric Company, Fort Worth, Tex.:					
Year 1908	1,080,577	630,052	450,525	189,541	260,984
Year 1907	1,060,953	595,072	465,881	157,003	308,878
People's Gas Light Company, Chicago, Ill.:					
Year 1908	13,738,970	8,222,625	5,516,345	1,884,300	3,632,045
Year 1907	13,146,367	7,973,626	5,172,741	1,810,550	3,362,191
Seattle Electric Company:					
Year 1908	4,520,488	2,670,252	1,850,236	989,374	860,862
Year 1907	4,119,724	2,421,404	1,698,320	832,941	865,380
Tarrytown, White Plains & Mamaroneck Railway Company:					
Quarter ended Dec. 31, 1908	32,559	49,222	*16,663	.....	.....
Quarter ended Dec. 31, 1907	31,548	38,961	*7,413	.....	.....

*Deficit.

GENERAL NEWS

Construction News.

BREWTON, ALA.—The installation of an additional engine and generator in the municipal electric and water-works plant is under consideration.

CAMDEN, ALA.—The citizens are considering the question of establishing a municipal electric lighting plant.

MOBILE, ALA.—The directors of the Home Telephone Company have authorized an expenditure of $75,000 for extensions and improvements to its plant in this city.

MESA, ARIZ.—The People's Independent Telephone Company is planning to install a new telephone system in Mesa.

PRESCOTT, ARIZ.—The City Council has granted a franchise to M. J. Hickey, Robert Brown and Henry T. Andrews to construct and operate an electric light and power plant, steam, hot water and cold storage systems; also telephone and telegraph systems.

RUSSELLVILLE, ARK.—Plans are being made by the Russellville Water & Light Company to establish an electric light plant and water-works system to furnish Russellville with water and electricity, and cities within a radius of 50 miles with electricity for lamps. The company has taken over the plant and franchises owned by the Russellville & Ozark Mountain Light & Transit Company, and will increase the output of the electric plant. The new equipment will include the installation of a 150-kw generator to be operated in conjunction with the 100-kw dynamo now in service. The work will include the construction of a new power house and dam on the Illinois River, near Russellville. The dam will be 400 ft. long with a 25-ft. head of water. Contracts for the water-works system will be let during the coming spring and summer. The cost of the work is estimated at $50,000.

BURBANK, CAL.—L. C. Brand has made a proposition to the city offering to build an electric street railway in Burbank, provided a bonus of $30,000 is raised and the right of way given.

EUREKA, CAL.—Plans are being made by the Pacific Telephone & Telegraph Company to construct a telephone line between Eureka and Crescent City this spring. The line will require about 80 miles of wire. E. McLaren is superintendent.

HOLLYWOOD, CAL.—Arrangements are being made by the Pacific Telephone & Telegraph Company for improvements and extensions to its local telephone system at a cost of about $45,000, of which $38,000 will be used in extension of lines.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company contemplates extensive improvements to its system in Los Angeles, which will involve an expenditure of about $500,000.

LOS ANGELES, CAL.—The City Council has passed an ordinance requiring all electric and telephone wires placed in underground conduits along the speedway from Hollister Avenue to the southern limits of the city at Marine Street.

SAN BERNARDINO, CAL.—The Home Telephone Company is making arrangements to rebuild its telephone system in this city, work on which will begin at once. An underground system will be installed within the fire limits. The cost of the work is estimated at $50,000.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has applied to the City Council for a franchise to extend its system into the eastern section of the city.

SAN DIEGO, CAL.—The Board of County Supervisors has granted a franchise to P. J. Schaniel and A. N. Jones giving them permission to use the tidewater at the entrance of False Bay for the purpose of operating an electric power plant. The company proposes to erect an electric plant to supply the bay and surrounding settlements with electricity for lamps and motors.

VALLEJO, CAL.—The Randall, Wright & Trowbridge Company, of Oakland, Cal., has applied to the City Trustees for a franchise for right of way over 10 miles of streets in Vallejo.

WHITTIER, CAL.—Arrangements are being made by the Whittier Home Telephone Company for improvements and extensions to its plant, which will include the installation of about 7000 ft. of lead-covered cable.

BOULDER, COL.—Prof. H. S. Evans, of the State University, has submitted to the City Council an estimate placing the cost of installing a hydro-electric plant in connection with the city water system to furnish electricity for lamps and motors at about $300,000, and for the distributing system for street lighting about $50,000. The city now pays $8,160 for street lighting service. The Council will not take any action at present.

DURANGO, COL.—Arrangements are being made to reorganize the Animas Power & Water Company, now in the hands of a receiver. Under the reorganization plans it is proposed to issue $1,000,000 in capital stock and $4,000,000 in bonds. From the proceeds of the bonds it is planned to take up the present indebtedness and the remainder to be used to enlarge the plant and carry out the original plans. The company now owns a 4000-hp plant on the Animas River between Durango and Silverton. D. H. Dalton, 62 Cedar Street, New York, N. Y., is secretary of the reorganization committee.

FAIRFIELD, CONN.—Arrangements have been completed by the United Illuminating Company, of New Haven, for taking over the charter of the Fairfield Power & Lighting Company and to install an electric lighting system in Fairfield.

WILMINGTON, DEL.—Contracts for furnishing electricity for lighting the court house and bridges have been awarded by the levy court as follows: For furnishing electricity for lamps and motors on Market Street, Eleventh Street and Washington bridges, and for lamps on court house lawn to the Wilmington City Electric Company, and for lamps for the interior of the court house to the Wilmington Gas & Electric Company. Each contract is for a term of four years. The levy court is considering the application of the Wilmington City Electric Company for a franchise to erect a transmission line along the county road from Elsmere to the Ferris Industrial School to furnish electricity for lamps and motors at the Ferris School.

WHITE SPRINGS, FLA.—The date for receiving bids for the construction of the large power plant on the Suwaunee River, near White Oaks, Fla., for the Suwaunee River Railroad & Power Company has been extended from Feb. 10 until March 15. D. G. Zeigler, & Company, of Jacksonville, Fla., will have charge of the work.

COLQUITT, GA.—We are informed that J. B. McCrary & Company, of Atlanta, Ga., will have charge of the construction of the proposed municipal electric light plant. The cost of the plant is estimated at from $10,000 to $15,000.

COLUMBUS, GA.—The Town Council has voted to appropriate $3,000 for carrying to the State Corporation Commission a case now pending between business men of the town and the Columbus Railroad Company in a matter regarding the price of electricity for lamps. The question will be taken up by experts and by them laid before the commission.

MILLEDGEVILLE, GA.—It is reported that a new company has been incorporated to furnish electricity for lamps and motors. The company has purchased the old power plant and is erecting new buildings and installing new machinery with an output of 500 hp. Arrangements are being made to install equipment in the Oconee River Mills by which water power will be utilized to operate the mills. A steam plant will be held in readiness for emergencies.

LEWISTON, IDAHO.—The City Council has granted a franchise to W. H. Bourke and associates, of Spokane, Wash., to construct and operate an electric light plant in this city. The plant is to be in operation by February, 1911.

LEWISTON, IDAHO.—The Spokane & Inland Railway Company will make application to the City Council for a franchise to construct and operate a street railway in Lewiston. The company has completed its railway as far as Moscow.

SANDPOINT, IDAHO.—Arrangements are being made by the promoters of the proposed electric railway which is to connect this city with Kootenai and Ponderay to commence work on construction of the road. A committee has been appointed to prepare incorporation papers for the company, which will be capitalized at $500,000.

SANDPOINT, IDAHO.—The Pend Oreille Water & Light Company has entered into a contract with the Humbird Lumber Company to furnish electricity and water for the new town of Kootenai, about two miles distant. The electric plant of the Humbird Lumber Company will be held in reserve in case of emergencies.

WEISER, IDAHO.—The Idaho-Oregon Light & Power Company will soon commence work on construction of its large substation in Weiser. The company was recently granted a franchise to furnish electricity in this town.

CHARLESTON, ILL.—The Coles County Telephone & Telegraph Company is planning to make improvements to its system, including the installation of a new switchboard and other appliances. The improvements will involve an expenditure of about $10,000.

DANVILLE, ILL.—Surveys are being made on the Vermillion River by Frank Payne, engineer, where it is proposed to develop the water power.

HOOPESTON, ILL.—The Hoopeston Gas & Electric Company has recently placed an order with the Minneapolis Steel & Machinery Company for a 100-hp Muenzel producer-gas engine. The company already has a 280-hp Muenzel producer plant, and the small engine will be used to run the light loads.

KANKAKEE, ILL.—Plans are being made to commence work on the construction of a large dam near Kankakee this summer to furnish power to generate electricity, which will be transmitted to cities along the Kankakee River as far as Joliet.

WATAGA, ILL.—Arrangements are being made by H. J. Kunkle to construct an electric light plant in Wataga, to cost about $40,000.

WAUKEGAN, ILL.—The North Shore Electric Company has placed orders for a third 2500-kw steam turbine for its power plant, with addi-

tional boilers and condensing apparatus to be installed at once, at a cost of about $150,000. The company has a contract to furnish electricity to operate the Milwaukee division of the Chicago & Milwaukee Electric Railroad Company, which will take effect about June 1.

BOONEVILLE, IND.—Arrangements are being made by the Chandler Telephone Company to commence work on the construction of a telephone line from Chandler to Boone, where it will install an exchange.

INDIANAPOLIS, IND.—Arrangements are being made by the Samuel H. Chute Company to install an electric light, heat and power plant on the East Side to furnish electricity for lamps and motors to all buildings on the entire square bounded by Central and First avenues, Fourth Street and University Avenue. L. P. and F. B. Chute are agents for the company.

KOKOMO, IND.—Orders have been placed by the Pittsburgh Plate Glass Company, of Kokomo, Ind., with the Allis-Chalmers Company, Milwaukee, Wis., for three units, consisting of gas engine and direct-current generator, with a total output of 2250 kw. The company has already installed a unit of 350 kw. It is reported that the Pittsburgh Plate Glass Company is to change its entire plant to electric-motor drive.

MEDARYVILLE, IND.—We are informed that it is proposed to install an electric light plant in Medaryville to furnish electricity for lamps in Medaryville and Francesville. E. O. Penry is clerk.

NORTH MANCHESTER, IND.—The Eel River Telephone Company has filed amendments to its charter increasing its capital stock from $10,000 to $40,000. Lewis Signs is secretary.

RICHMOND, IND.—The Richmond Light, Heat & Power Company contemplates extending its transmission lines to New Paris, Ind., to furnish electricity for street and commercial lighting.

WASHINGTON, IND.—The City Council has issued $20,000 in bonds, the proceeds to be used to pay off the indebtedness, to make necessary improvements and provide for running expenses of the municipal electric light plant recently taken over by the city.

BOONE, IA.—The Iowa Telephone Company contemplates extensive improvements to its local system this summer to cost about $25,000. It proposes to place a large part of its wires in cables.

CARSON, IA.—H. E. Johnson has purchased the local electric light plant and will improve the same.

CEDAR RAPIDS, IA.—The Cedar Rapids & Iowa City Railway & Light Company has selected a site for a dam near the Palisades, for which surveys have been completed. It is also proposed to construct a dam at Cedar Bluffs. William G. Dows is general manager.

DES MOINES, IA.—Bids will be received by the Board of Supervisors of Polk County at the office of the county auditor, Des Moines, Ia., until March 1, for the installation of an electric light and power plant for the Polk County Court House and jail, according to plans and specifications which may be seen at the above office and at the office of Proudfoot & Bird, architects, 625 Flynn Building, Des Moines, Ia. Harry B. Frase is county auditor.

FAIRFIELD, IA.—The City Council has decided to abandon the municipal electric light plant and to secure electricity for lighting the streets of the city and for pumping the city water from the Fairfield Gas & Electric Company, which will soon install a new plant with duplicate machinery at a cost of from $25,000 to $30,000. The company will also furnish a day electric service.

FARMINGTON, IA.—The question of installing a larger generator in the municipal electric light plant in the near future is under consideration. P. O. Petersen is superintendent.

SHANNON CITY, IA.—It is reported that plans are being considered for the construction of an electric light plant in Shannon City.

SIOUX CITY, IA.—The Sioux City & Spirit Lake Railway Company has secured franchises in the towns of LeMars, Ia.; Paullina, Primghar, Hartley and Spirit Lake for its proposed electric railway to extend from Sioux City to Spirit Lake, a distance of 108 miles. The Westinghouse, Church, Kerr & Company, New York, N. Y., are engineers and contractors. William H. Beck, of Sioux City, Ia., is president of the company.

ARKANSAS CITY, KAN.—The Arkansas City Electric Light Company, which is owned by the Land & Power Company, is constructing a new power plant, the equipment of which will include three 460-hp Leffel Sampson turbines, three 250-kw, 2200-volt, 3-phase, 60-cycle, Bullock generators; two 400-hp Corliss engines, Reynolds type, and four boilers manufactured by the Kewanee Boiler Company. The company will furnish electricity to operate the proposed electric railway of the Southwestern Interurban Railway Company, now under construction, and expects to commence operation in April. Contracts for the above equipment have been awarded. A. L. Newman is secretary.

JUNCTION CITY, KAN.—The City Council has granted a franchise to the Rocky Ford Milling & Power Company to furnish electricity in Junction City for lamps and motors. The company is constructing a large dam across the Blue River, near Manhattan, 26 miles distant, and also proposes to supply electrical energy in Manhattan and Fort Riley.

MARION, KAN.—At a special election held Feb. 9 the citizens voted to issue $60,000 in bonds, the proceeds to be used for the construction of an electric light plant and water-works system.

PITTSBURG, KAN.—The Joplin & Pittsburg Railway Company has been granted a franchise by the City Council to extend its Elm Street line to the grounds of the Manual Training Normal School, and also to Cherokee, Franklin and the camps in the north part of Crawford County. After the above extensions are completed the company is planning to build a railway extending from Pittsburg to Mulberry.

TOPEKA, KAN.—Plans are being considered for a permanent electric lighting system in Garfield Park, which will be installed as soon as the municipal electric light plant has been remodeled.

FRANKFORT, KY.—The Capital Gas & Electric Light Company contemplates installing an entire new plant as soon as possible. Farnk Austin is secretary and manager.

LEXINGTON, KY.—Arrangements are being made by the Midland Electric Company to erect a new power house to cost about $25,000.

BERWICK, LA.—Plans are being made to install an electric plant in Berwick. It is also proposed to install a day service.

MANSFIELD, LA.—The municipal electric light plant was sold Feb. 3 by the City Council to J. L. Logan, of Texarkana, Tex., for $6,150. The plant was erected by the city at a cost of about $8,000 and has not proven a paying investment. It is understood that the purchaser represented the Mansfield Ice Company and that the two plants will be consolidated.

BETHEL, MAINE.—At a special village corporation meeting held recently the citizens voted to appropriate $800 for the installation of an electric lighting system. A committee consisting of Ceylon Rowe, E. C. Bowler and D. S. Hastings was appointed to make further investigations in regard to the lighting and report at the next meeting of the corporation.

BERLIN, MD.—Sealed proposals will be received until March 16 by the Mayor and Council of Berlin, Md., for the construction of an electric light plant and water-works system. The work is to be divided into seven divisions, which may be bid upon separately or collectively. The work is subdivided as follows: Division A, water distribution system; Division B, poles, lines, wiring and electric street lamps; Division C, power plant building, foundations for machinery, boiler and standpipe; Division D, power plant equipment, including a 100-hp boiler, one 50-kw generating unit, one 500-gal. per minute duplex water pump, switchboard, piping and accessories; Division E, standpipe (12 ft. by 125 ft.); Division F, wells (3 in. and 8 in., and probably not more than 100 ft. deep). Plans and specifications may be seen at the office of Dodge & Day, engineers, 608 Chestnut Street, Philadelphia, Pa. Copies of plans and specifications may be had by placing a deposit of $10, which will be refunded when plans are returned.

TOWSON, MD.—The Mount Washington Electric Light & Power Company, of Mount Washington, Md., has been making investigations in the villages of Cockeysville and Texas with a view of furnishing electrical service, and has decided that if a sufficient number of patrons can be secured to warrant the expense it will extend its transmission lines to the villages. The County Commissioners have been asked to install electric lamps along the road.

ATLANTIC, MASS.—The citizens are considering the question of having a lighting system installed on the new boulevard.

CAMBRIDGE, MASS.—Preparations are being made by the Cambridge Electric Light Company to install two 300-hp boilers, which will complete the motive power equipment of the plant as originally planned. Six boilers are now in commission.

CHELSEA, MASS.—The Chelsea Gas Light Company contemplates replacing its transmission lines destroyed by the fire. Joseph M. Riley is assistant general manager.

COHASSET, MASS.—It is reported that Stone & Webster are to take over the plant and holdings of the Cohasset Electric Light Company. It is said that the Cohasset plant will be eventually discarded and electrical service will be furnished from the Brockton plant. If the change is made a 24-hour service will be established.

ENFIELD, MASS.—A. W. Mason is reported to have purchased the Blodgett box shop and electric light plant at Soapstone, near North Dana.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company is planning to extend its transmission lines up through the county farms district to furnish electricity for lamps and motors to the farmers in that vicinity.

HYDE PARK, MASS.—At a special town meeting held Feb. 10 the citizens voted to authorize the Selectmen to enter into a contract with the Hyde Park Electric Light Company for street lighting for a term of ten years. Under the terms of the contract the company is to furnish 540 tungsten incandescent lamps of 40 cp and 73 2000-cp arc lamps for $13,800 per year, with an all-night and every night service. The company has agreed to reduce the price of electricity for residential lighting from 20 cents to 15 cents per kw-hour, with a further discount of 10 per cent on all bills paid by the 15th of the month; also to furnish renewal of lamps with the exception of tungsten lamps.

LOWELL, MASS.—The Moore Spinning Company is planning to enlarge its plant and will install two 1500-hp turbine engines. The mill will be operated by electricity when the new engines are installed.

LOWELL, MASS.—The management of the Musketaquid Worsted Mills has awarded contracts for the erection of an addition to its plant. A new power plant and water wheel will be installed. E. J. Hylan is agent.

MIDDLETON, MASS.—Matthew M. Merritt has applied to the Selectmen for a franchise to supply electricity for lamps and motors in Middleton.

NORTH BROOKFIELD, MASS.—The Oxford Linen Mills Company has purchased land and water rights along Mad Brook, below the North Brookfield reservoir and pumping plant. The company proposes to develop the water power to be utilized to generate electricity to be transmitted to its plant, two miles distant. The present plans call for the consruction of a dam 60 ft. long and the installation of one or more turbine water wheels, which will develop from 150 to 250 hp.

ORANGE, MASS.—The plant and holdings of the Orange Electric Light Company have been purchased by Wallace G. Webber and associates, of Boston, Mass. It is said that the new owners will enlarge and improve the plant. The officers of the new company are: Wallace G. Webber, president; Edward C. Mason, of Boston, Mass., treasurer, and A. W. Hubbard, general manager.

BENTON HARBOR, MICH.—The Benton Harbor-St. Joe Railway & Light Company is planning to construct a 12-mile extension from Benton Harbor this spring. The company will probably ask for bids for construction of the same. H. C. Mason, of Benton Harbor, is general manager.

CHESANING, MICH.—The Chesaning Home Telephone Company, organized by local business men, has taken over the Bell telephone system in Chesaning.

HILLMAN, MICH.—The Hillman Light & Water Company contemplates extending its transmission lines to Atlanta during the coming year. L. C. Rouse is superintendent.

RAMSAY, MICH.—Plans have been completed for the installation of an electric plant at the Eureka mine at Ramsay to furnish electricity for lamps for the mines and houses and operate the surface tramway. Later when conditions will warrant the company will install electrical service underground for hauling, etc. Charles C. Jones is superintendent of the mine.

DEER RIVER, MINN.—The City Council has granted a franchise to the Itasca Telephone Company to erect a telephone system in Deer River.

KERKHOVEN, MINN.—Arrangements are being made to organize a telephone company for the purpose of erecting about 15 miles of telephone line. Joseph Holmgren and others are interested in the project.

MILLVILLE, MINN.—S. D. Pierce and E. Dickman contemplate developing the water power of the Zumbro River, which will be utilized to furnish power to operate an electric light system.

MINNEAPOLIS, MINN.—The residents of the Linden Hills district, of Minneapolis, are contemplating installing an electric light plant, for which an application for a franchise will soon be made to the City Council.

PINE RIVER, MINN.—James E. Geary has been granted a franchise to erect a telephone line in Pine River.

REDWOOD FALLS, MINN.—Work has commenced on the construction of the new power house and improvement of the water power development.

HATTIESBURG, MISS.—The Hattiesburg Traction Company is planning to increase the equipment of its power plant by the installation of two 500-kw turbo-generators and a motor generator set for railway service.

NEWTON, MISS.—The Clarke Memorial College, Newton, Miss., it is reported, contemplates installing an electric light plant.

CHILHOWEE, MO.—It is reported that the town of Chilhowee has awarded a contract for the construction of an electric light plant, to be completed and in operation within six months.

KANSAS CITY, MO.—The contract for the construction of the power house, laundry and smokestack at the poor farm has been awarded by the county court to Yetter & Kleinhoffer, for about $19,000.

KIRKSVILLE, MO.—G. W. Strubher and George E. Woodhouse, of Peoria, Ill., are interested in a project to construct an electric railway from Connelsville, through Novinger and Kirksville, to Gibbs. The proposed railway will be about 30 miles in length and will cost approximately $1,000,000. Another railway is being promoted from Hannibal to Kirksville, with a view of connecting the two systems at Gibbs.

MACON, MO.—Preparations are being made for increasing the output of the municipal electric light plant, which will include the installation of a 300-hp engine, a 125-hp tubular horizontal boiler, a three-phase alternator with a rating of from 200 to 250 kw, centrifugal pumps, etc. The proposed improvements will involve an expenditure of about $18,400. E. S. Bennett is superintendent.

MARYVILLE, MO.—It is reported that the electric plant of the Rockford Electric Light Company, recently destroyed by fire, will be rebuilt at once. James L. Clark is manager.

OZARK, MO.—The Water Power Light Company contemplates increasing the output of its plant at a cost of about $5,000. The equipment will include an additional 50-kw, alternating-current generator, another water turbine and possibly a 100-hp automatic engine. When the above improvements are completed the company may add a storage battery of about 30-kw capacity to its uptown receiving station. The company next season will probably install an ice and cold storage plant and would like to communicate with manufacturers of ice machinery, where no steam is required to make cake ice. S. E. Bronson is secretary and manager.

ST. LOUIS, MO.—The bid of the Union Electric Light & Power Company to furnish electricity for lighting the public building has been approved by the Board of Public Service. The contract is for a term of 10 years at the rate of 3¾ cents per kw-hour, which is a reduction of about 30 per cent from the price now being paid for the service. The contract takes effect Sept. 1, 1909. The board has withheld its approval of the bid for electric lighting in the downtown district to give the Downtown Lighting Association an opportunity to confer with the Union Light & Power Company in regard to furnishing new arc lamps in the downtown streets.

UNIVERSITY CITY, MO.—Plans are being considered by the City Council for extensive improvements to the city, including the installation of a lighting plant.

PHILLIPSBURG, MONT.—The Phillipsburg Granite Electric Light Company has leased its electric plant to Bowen Brothers, who will improve the plant and install a new gas engine. The new owners have secured a contract for lighting the streets of the city for a term of three years.

ARAPAHO, NEB.—At a special election held Feb. 9 the citizens voted to construct an electric light plant to cost about $6,000. E. C. Wagner is city clerk.

FAIRMONT, NEB.—The Fairmont Water Company, it is stated, has decided to install an electric light plant in connection with its water-works system.

HARVARD, NEB.—The Harvard Telephone Company is planning to add 4000 ft. of cable to its system.

HOLDREDGE, NEB.—The Holdredge Lighting Company is contemplating extending its transmission lines to nearby towns to furnish electricity for lamps.

NEBRASKA CITY, NEB.—The Nebraska City Water & Light Company has submitted a proposition to the City Council asking for a 20-year franchise.

SUTTON, NEB.—The electric plant of the Sutton Electric Light & Power Company has been purchased by the Jacob Sack Lumber Company, which has enlarged the plant. The company has over 200 hp more than it is using and is offering electricity for power purposes at a very low rate in order to induce outside parties to locate in Sutton and engage in manufacturing business.

TONOPAH, NEV.—Senator T. L. Oddie, of Tonopah, has secured an option on water rights of the Kings River, near Independence, Cal., on the west slope of the Sierras, where it is estimated that 300,000 hp can be developed.

TONOPAH, NEV.—The directors of the Round Mountain Mining Company have decided to increase the output of the mill to 110 tons a day. A compressor with 10 drills and one tubular mill will be added. The plant is being equipped to be operated by electricity, which, it is expected, will be completed by May 1.

EAST TILTON, N. H.—The East Tilton Village Improvement Society is considering the question of lighting the streets of the village. It is proposed to establish an electric light plant.

LITTLETON, N. H.—The Littleton Telephone Company, recently incorporated, is planning to commence work on the erection of its lines this spring. George A. Edson is president.

MILFORD, N. H.—The McLane Manufacturing Company is making arrangements to equip its mill, to be operated by electricity.

GREENLOCH, N. J.—Plans are being considered to install an electric light plant in Greenloch, where it is said a water power will be developed to furnish power to operate the plant.

JERSEY CITY, N. J.—The commissioners have adopted a resolution directing the Street and Water Board to take measures to have all overhead electric wires placed underground without delay.

MADISON, N. J.—The light committee has submitted a recommendation to the Borough Council to enter into a five-year contract to furnish the Borough of Florham Park with electricity, as follows: Up to 100,000 kw at 12 cents per kw-hour; 150,000 kw at 11½ cents per kw-hour, and 200,000 kw at 11 cents per kw-hour; the cost of construction and equipment to be paid by the Borough of Florham Park. The report was referred to the light committee to enter into a contract if advisable.

NEWARK, N. J.—Plans have been adopted by the Broad Street Improvement Association for improving the street lighting system on Broad Street, between Market Street and Central Avenue. It is proposed to erect 41 flaming-arc lamps at an estimated cost of $3,800. It is estimated that it will cost $21,600 per year to maintain the lamps.

VERONA, N. J.—The Borough Council has decided not to execute a contract with the Public Service Corporation for street lighting at an advance of $4 per lamp per year over the present price. The borough may install a municipal plant or use some other illuminant for street lighting.

CLOVIS, N. M.—Plans are being prepared by Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., for the installation of an electric light plant, water-works system and sewerage system for Clovis, to cost about $125,000.

ARCADE, N. Y.—The new municipal electric light plant is nearly completed and is expected to be put in operation during this month.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has established a new system of charges for electricity for lamps to take effect from Feb. 1. The minimum charge for residential use will be $1.10 per month and the flat rate will be that amount for anything up to six lamps; for ten lamps, $1.65 per month; 15 lamps, $2.10; 20 lamps, $2.90; 30 lamps, $3.25, and $3.85 for 40 lamps. In addition to the flat

rate, a charge of 2¼ cents per kw-hour will be made. The present meter rate is 15 cents per kw-hour. A discount of 10 per cent will be made on all bills paid before the 10th of the month.

BUFFALO, N. Y.—The Buffalo & Lake Erie Traction Company has applied to the City Council for a franchise to construct a street car line out to the new dock at the foot of State Street.

DANSVILLE, N. Y.—The Dansville Gas & Electric Company has filed a petition with the Public Service Commission, Second District, for permission to issue a mortgage for $100,000 to secure an issue of bonds.

GLENS FALLS, N. Y.—Plans are being considered by the Glens Falls Gas & Electric Company for improvements to its plant, which will include the installation of a new switchboard in the local station and the erection of a duplicate high-tension transmission line from the power house at Bakers Falls to the station in Glens Falls. The cost of the work is estimated at $20,000.

LYONS, N. Y.—The Wayne County Electric Company has decided to install new machinery to increase the output of its plant in order to fulfill its contracts with the villages of Lyons and Clyde for street lighting and other purposes. The company has made arrangements to secure electricity from outside sources until the new equipment is installed.

NEW YORK, N. Y.—The Hudson & Manhattan Railroad Company has applied to the Public Service Commission for permission to extend its Sixth Avenue tunnel to the Grand Central Station.

NEW YORK, N. Y.—Judge Lacombe, of the United States Circuit Court, has signed an order authorizing Frederick W. Whitridge, receiver of the Third Avenue Railroad Company, to construct a double-track extension from Fort George, across the Harlem River, to and along Pelham Avenue and the Southern Boulevard, to the Zoological Gardens in the Bronx.

NIAGARA FALLS, N. Y.—Plans are being prepared by W. D. Robbins, city engineer, and Walter McCulloch, consulting engineer, for a new water-works system and filtration plant to be erected at Niagara Falls, at an approximate cost of $750,000. The equipment of the plant will include three 6,000,000-gal., motor-driven, low-pressure pumps; four 6,000,000-gal., motor-driven, high-pressure pumps; two 5,500,000-gal., motor-driven, high-pressure pumps, at an estimated cost of $33,000. The pumps are to be of the turbine type. About 800 hp of electrical power will be required to operate them, which will be purchased from the local power company. Bids for material and construction will be received about April 1.

ROCHESTER, N. Y.—The contract for equipping the new wood-working factory of the John Hoffman Company, Rochester, N. Y., with motor drive has been awarded to the Crocker-Wheeler Company, of Ampere, N. J. The equipment includes a generator, three lighting transformers, 40 induction motors, ranging from 1 to 30 hp. Each machine is equipped for individual motor drive.

ROME, N. Y.—It is reported that the City Council is considering the question of establishing a municipal electric light plant.

SYRACUSE, N. Y.—Bids will be received until March 1 by the building committee, consisting of Robert Dey, T. W. Meachem, C. W. Snow and DeForest Settle, at the Chamber of Commerce rooms, Syracuse, N. Y., for the construction of a 400-room hotel on Jefferson Street, Syracuse, N. Y., for the Onondaga Hotel Company. Separate proposals will be received at the same time for a complete power, lighting, heating and refrigerating plant, including boilers, pumps, stokers, grates, smoke connections, setting boilers, trimmings, engines, generators, switchboards, motors, ventilating apparatus and ice-making and refrigerating machinery.

UTICA, N. Y.—It is understood that a proposition will soon be submitted to the Board of Supervisors to install an electric light plant to furnish electricity to light the county buildings, including the court house, armory and jail. It now costs the county $10,000 per year to light the three buildings.

VICTOR, N. Y.—At a meeting of the Victor Civic League the citizens voted to install an electric lighting system in Victor. Mr. Colgate, representing the Niagara Power Company, has submitted a proposition showing that the village could be lighted with 70 incandescent lamps of 40 cp for $1,000 per year. A five-year contract for street lighting will be required with the franchise.

ASHEVILLE, N. C.—Formal decree has been signed in the state courts here for the sale of the Asheville Rapid Transit interests to R. S. Howland and associates. The bid of Mr. Howland was $25,000, and the acquired property will be utilized in connection with the Asheville-Weaverville development now under construction.

ASHEVILLE, N. C.—Announcement is made that the contract will be let within 60 days for the construction of an electric railway for the North Carolina & Tennessee Railroad Company from Weaverville, N. C., to Huntdale, from the coal fields of West Virginia to the seaboard. The line will be an extension of the Asheville-Weaverville electric road, which is now under construction, and will be equipped with high-speed cars.

CHARLOTTE, N. C.—The Charlotte Electric Railway, Light & Power Company has effected a division of the power and lighting and the street railway systems. The lighting and power interests have been incorporated, with a capital stock of $300,000, under the name of the Charlotte Gas & Electric Company. The president of both departments of the business is E. D. Latta. The company has for several years contemplated the extension of its lines to the Catawba River, 12 miles distant, and to establish a pleasure park on the river. The recent action of the directors in dividing the business indicates that developments are to be expected soon. The division of the business is also accompanied by the provision for a large increase in capitalization whenever such is deemed necessary. The company is this winter expending about $100,000 in local improvements on its car line and tracks.

GREENSBORO, N. C.—Investigations are being made by John A. Hodkin, J. S. Kuykendall, secretary, Chamber of Commerce, both of Greensboro, and B. T. Thyson, civil engineer, of Roanoke, Va., for developing the water power of Deep River, to be utilized to generate electricity to be transmitted to Greensboro. The distance from Greensboro to the proposed dam site is about 44 miles. It is estimated that 4000 hp can be developed.

HIGH POINT, N. C.—Coler & Company, who have purchased certain franchises in High Point, have made a proposition to this town which has been accepted, in which it is provided that an electric street car system is to be in operation inside of 12 months and an interurban line within two years, the electric company also agreeing not to compete with the city in the sale of electricity for lamps, the town owning its own electric lighting plant. Electric railways will be built to Greensboro and to Winston, the Coler interests having purchased electric railway interests in Greensboro.

LAURINBURG, N. C.—The local electric light plant has recently doubled its output to meet the increased demand for electrical power.

MADISON, N. C.—It is reported that the Madison Grocery Company is interested in a proposed water power development about four miles from Madison to furnish power to operate electric plants at Madison and Mayodan.

NORTH WILKESBORO, N. C.—The town has purchased from J. G. and R. N. Hackett a hydro-electric power plant for $23,000. The plant includes an excellent water power from which the city now derives power to generate electricity for lighting the town.

WILMINGTON, N. C.—A proposition is being considered to build a telephone line from Wilmington to Jacksonville, N. C.

WINSTON-SALEM, N. C.—The County Commissioners have granted a franchise to John D. Williams and others to erect a telephone line from Lewisville to Clemmons.

CANAL DOVER, OHIO.—We are informed that plans and specifications for the construction of a municipal electric light plant at Canal Dover, Ohio, are on file at the office of John T. Morris, consulting engineer, 621 Columbus Savings & Trust Building, Columbus, Ohio.

CANAL DOVER, OHIO.—Franchises have been granted to S. J. Gerber and Edwin Schweitzer by the Village Councils of Sugar Creek, Sbanesville, Baltic and Sugar Creek Township Trustees for the erection and maintenance of an electric light plant.

CINCINNATI, OHIO.—Bids will be received by the Board of Public Service until Feb. 18 for furnishing materials and labor for the improvement of Eden Park tower, including rewiring and furnishing with necessary sockets, bushings, wire, condulet, cut-outs, switches, etc., according to plans and specifications on file at the office of the city electrician. Bidders are required to use the printed forms. John J. Wenner is city clerk.

CLEVELAND, OHIO.—The Cleveland Salt Company has placed an order with the Lincoln Electric Company, of Cleveland, for 32 motors, aggregating about 600 hp, for driving the machinery in its salt plant.

COLUMBUS, OHIO.—The Public Service Board has filed a recommendation with the City Council for the purchase of a new 2000-kw generator for the municipal electric light plant. The new machine is needed to furnish electricity for lamps in the additional territory to be annexed. The cost of the machine is estimated at about $45,000.

LIMA, OHIO.—Bids will be received by the Board of Public Service until Feb. 20 for lighting the streets of the city.

PHILO, OHIO.—The Center Valley Light & Power Company has awarded the contract for the construction of a power plant on the site of the William Frazier mill at Philo, to A. W. McDonald, of Steubenville, Ohio, to cost $260,000. According to the present plans, two buildings will be erected, one of which will be used for the main generating plant and the other for an auxiliary plant. The plants will have an output of 2800 hp. Four double turbines will be installed; both steam and water will be used for motive power. The company proposes to furnish electricity for lamps in the villages of Philo and Duncan Falls.

SPRINGFIELD, OHIO.—Only one bid was received by the Board of Public Service for lighting the streets of the city, which was submitted by the Citizens' Light & Power Company, of which P. H. Flynn is president. The company offers to furnish 75 or more mineralized carbon arc lamps at $84 per lamp per year; for 100 or more tungsten lamps at $30 per year per lamp, and for 125 or more arc lamps at $61.92 each per year.

WESTERVILLE, OHIO.—Plans are being considered for the installation of new boilers and boiler feed pump in the municipal electric light plant. D. H. Crawford is superintendent.

WEST TOLEDO, OHIO.—The Township Trustees are considering the question of lighting the streets by electricity. It is probable that an electric light plant will be installed as a private enterprise. Electricity will be furnished to private consumers also.

MINCO, OKLA.—Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., are preparing plans and specifications for an electric light plant and water-works system for this city, the cost of which is estimated at $20,000.

MUSKOGEE, OKLA.—Plans for the construction of a large power plant on the Grand River, a few miles below Muskogee, are being revived by C. N. Haskell and D. N. Fink. The proposed plant will cost about $1,000,000 and will furnish electricity to cities within a radius of 50 miles.

TONKAWA, OKLA.—Plans and specifications are being prepared by Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., for an electric light plant, water-works and sewer systems in Tonkawa, to cost about $38,000.

BAKER CITY, ORE.—The plant and holdings of the Baker Light & Power Company have been purchased by the Elkhorn Light & Power Company, recently incorporated by F. M. Harmon, L. Summers and John Rand. The company is capitalized at $10,000 and will also manufacture and sell gas.

HOOD RIVER, ORE.—The Hood River Light & Power Company is planning to make improvements and additions to its system, which will include the purchase of equipment, as follows: One 750-kw 6600-volt alternating-current generator, a 1500-hp turbine and rewiring. A reservoir will also be built and a 60-in. valve will be placed in the main pipe near the power house. A reservoir will also be constructed in connection with the water-works system.

REDMOND, ORE.—It is reported that a company is being formed to install an electric plant at Gline Falls to furnish electricity in Redmond. J. G. Guffie is interested in the project. A notice of appropriation of water rights has been made.

ROSEBURG, ORE.—Application has been made to the Common Council by Milton Purdy for a franchise to construct and operate a street railway in Roseburg.

ALLENTOWN, PA.—It is stated that the Inter-City Electric Railway Company, recently incorporated to construct an electric railway between Allentown and Reading, proposes to ask for franchises in Allentown and Reading, and will also bid on electrical contracts in both cities and in towns along its railway between the two cities.

BEAVER, PA.—It is reported that an Eastern syndicate has secured an option on the holdings of the Beaver Falls Water Power Company on the Beaver River, at Beaver, for $100,000. It is said, should the deal go through, that it is proposed to erect a large electric power plant to furnish electricity for the Beaver Valley towns.

CARNEGIE, PA.—The Scott Iron Works, of this place, have awarded a contract to the Lincoln Electric Company, of Cleveland, Ohio, for the installation of a 75-kw generator and two motors, one 50 hp and the other 7½ hp, in its plant.

EASTON, PA.—The consolidation of the Easton Transit Company and the Easton & South Bethlehem Transit Company, under the name of the Easton Transit Company, has been approved by Governor Stuart. The consolidated company is capitalized at $2,150,000.

GASTONVILLE, PA.—Arrangements are being made to enlarge the Gastonville power plant to furnish additional power for the Cincinnati and Coal Bluff mines. The work will include the installation of a new boiler plant and a 150-kw generator.

PHILADELPHIA, PA.—An ordinance has been introduced in the Council by Chief McLaughlan, of the Electrical Bureau, to appropriate $45,000 to replace cables, poles and mastarms between City Hall and McKean Street; also for $6,000 to install dynamos to replace the old bluestone batteries at the police station.

PHILADELPHIA, PA.—Mayor Reyburn has approved the plans prepared by Chief McLaughlin, of the Electrical Bureau, for improving the electric lighting system on Market, Broad, Walnut, Chestnut and other streets in the center of the city. The proposed plan contemplates the erection of ornamental poles and arc lamps of high candle-power. The plans also provide for clearing the streets of all overhead wires excepting trolley cables.

SUSQUEHANNA, PA.—The Borough Council has awarded the contract for lighting the streets and public buildings of the borough to the Susquehanna Electric Company for a term of five years, dating from Feb. 1, 1909. The company is to furnish 10 arc lamps and 83 incandescent lamps for $2,400 per year.

WEST NEWTON, PA.—It is reported that the Borough Council is negotiating with H. D. Hershey, superintendent of the Latrobe Street Railway Company, with a view of selling the municipal electric light plant to the West Penn Railways Company. The plant has been in operation for 15 years, and the management of the plant is a burden to the Council, and there are some who are in favor of selling the plant.

SPARTANBURG, S. C.—The Spartanburg electric railway will be extended to the Saxon Cotton Mills and probably to the Whitney Mills, three and six miles distant.

RAMONA, S. D.—Arrangements are being made to form a company for the purpose of installing an electric light plant in Ramona. It is proposed to construct the plant early in the spring.

JACKSON, TENN.—Plans are under consideration for increasing the output of the municipal electric light plant.

FLATONIA, TEX.—It is reported that the electric light plant, owned by F. A. Ziegelbaur, has been destroyed by fire.

SALT LAKE CITY, UTAH.—It is reported that the Deer Creek Copper & Gold Mining Company is planning an extensive development on the American Fork River. A contract has been awarded to construct the tunnel and the company will probably install a power plant soon. W. M. Odell, of Salt Lake City, Utah, is interested in the enterprise.

WINDSOR, VT.—The Windsor Electric Light Company is contemplating extending its day power service, and, if conditions warrant, it will install a 3-phase power circuit. Richard P. Osgood is superintendent.

ALEXANDRIA, VA.—It is understood that arrangements have been completed whereby the plant of the Alexandria Electric Light Company will be transferred to local capitalists, who it is said will increase the output of the plant and make other improvements to the system. The plant is now owned by a Pennsylvania syndicate.

ONLEY, VA.—Plans are being made by H. L. East to install an electric plant to operate his laundry and also to furnish electricity for lamps in the town.

ROCKBRIDGE ALUM SPRINGS, VA.—Estimates are being received by J. W. Bell, general manager of the Rockbridge Alum Springs, on acetylene and electric lighting plants.

ROCKY MOUNT, VA.—A company is being organized in this place to establish an electric light plant. The equipment of the plant will include a 75-hp engine and a 56-kw generator. B. L. Fisher is interested in the enterprise.

BELLINGHAM, WASH.—Arrangements are being made by the residents of Austicana Colony whereby the Whatcom County Railway & Light Company will furnish electricity for lamps and motors in that district, and also to operate the water pumps. A telephone system will also be installed.

CHEHALIS, WASH.—The Chehalis & Boistfort Telephone Company contemplates extensive improvements and extensions to its system.

CHEWELAH, WASH.—The local business men are considering the question of securing electricity for lamps and motors for the United Copper mine and the Copper King mine, and also for the town, from the plant of the Stevens County Electric Light Company, located at Meyers Falls, Wash. The municipal electric plant, which was installed about 18 months ago, is inadequate to meet the demands for electricity.

FRIDAY HARBOR, WASH.—Robert Moran has applied to the Commissioners of San Juan County for a franchise to construct and maintain transmission lines for the distribution of electricity on Orcas Island.

NORTH YAKIMA, WASH.—Notice of appropriation of 10,000 cu. ft. of water per second from the Yakima River has been filed by R. B. Brown, of Seattle, Wash. The water is to be utilized to generate electricity to operate a street railway and manufacturing plants; also to supply electricity to cities and towns for lamps and motors.

SEATTLE, WASH.—The City Council has granted the Seattle, Renton & Southern Railway Company a franchise to construct an electric railway on Third Avenue and Pine Street.

SEDRO-WOOLLEY, WASH.—The Skagit Improvement Company will lease the plant of the Sedro Ice & Storage Company for a term of five years. The plant will be operated by electricity and the output increased.

STEVENS, WASH.—The Skamania Co-operative Telephone Company has been granted a franchise to extend its telephone lines along the county roads.

TAYLOR, WASH.—The capital stock of the Citizens' Light & Power Company has been increased from $20,000 to $40,000.

VANCOUVER, WASH.—The Portland Railway, Light & Power Company is making arrangements to place an electric cable under the Columbia River to transmit electricity to the substation at Vancouver, which will furnish electricity to local street railway and electric light and power systems. The local power station will be kept in readiness for emergencies. The company is planning to make improvements to its local system during the coming year, which will involve an expenditure of about $25,000, and include the installation of automatic regulators and other equipment. The new cable will transmit electricity from the power stations at Oregon City and Cazadero.

BLUEFIELD, W. VA.—The Bluestone Traction Company contemplates the installation of additional equipment in its plant, including a 450-hp engine.

TRIADELPHIA, W. VA.—The Farmers' Mutual Telephone Company has applied to the County Commissioners for a franchise to erect telephone lines along the highways of the Triadelphia district.

BLAINE (P. O. ALMOND), WIS.—The capital stock of the St. Croix Farmers' Mutual Telephone Company has been increased from $3,000 to $6,000.

COWICHAN, B. C., CAN.—The Parker Electric Company, of Nanaimo, B. C., is installing electric generating equipment in Cowichan.

EDMONTON, B. C., CAN.—Plans are being considered by the city for developing the water power of Athabasca River, at Grand Rapids, 150 miles northwest of the city, where it is estimated that 250,000 hp can be developed. The cost of the transmission line is estimated at about $1,500 per mile.

KAMLOOPS, B. C., CAN.—The City Council has engaged H. K. Dutcher, of Cleveland, Ohio, to make investigations and make a report for reorganizing the municipal electric light and pumping plant.

VANCOUVER, B. C., CAN.—It is reported that the British Columbia Electric Railway Company is planning to obtain the two large water powers of the Fraser Valley, Stave Lake Falls, near Ruskin, and the Vedder Falls, near Chilliwack, and to build a belt line railway, of which the Chilliwack line will be a part.

VANCOUVER, B. C., CAN.—Plans are being conisdered by the Canadian Industrial Company for the construction of a large paper and pulp mill on the Powell River. A 5000-hp hydro-electric plant will be built in connection with the enterprise. Alfred Carmichael, hydraulic engineer, has been making investigations for developing water power for the company.

BIRTLE, MAN., CAN.—This municipality is considering the installation of a telephone system. For further information address W. C. O'Keele, Birtle, Man.

PORTAGE LA PRAIRIE, MAN., CAN.—A local company is applying to the City Council for a franchise to erect poles on the streets and supply electricity for lamps, heat and motors. For further information address E. A. McPherson.

WINNIPEG, MAN., CAN.—Instructions have been issued by the Canadian Pacific Railroad Company for the installation of a telephone line between Winnipeg and Brandon for the operation of trains. The distance is 135 miles, and if the system proves successful, telephone wires will be installed on all the company's lines in western Canada.

BROCKVILLE, ONT., CAN.—A company has been formed and is negotiating to supply this city with electricity generated by water power of the Iroquois River.

BROCKVILLE, ONT.—M. W. Beach, of Iroquois, Ont., has submitted a proposition to the Council offering to transmit electricity from Iroquois to Brockville. If sufficient business is guaranteed, he proposes to erect transmission line and furnish electrical service in this town. He offers to sell to the town outright the distributing system, or will operate the system, provided sufficient business is guaranteed. He also proposes to supply the water department with electricity. The transmission line would pass through Prescott and Cardinal, and Mr. Beach is negotiating with these municipalities to furnish electrical service.

LONDON, ONT.—The London & Northwestern Railway Company has applied to the Ontario Legislature for a charter to construct an electric railway from London to Sarnia, and from London to a point on Lake Huron.

PETERBORO, ONT.—Preliminary plans have been prepared for the proposed municipal power plant, including the construction of a dam, power house and pumping plant. S. R. Armstrong is City Clerk.

PETERBORO, ONT., CAN.—The Water Commissioners have asked the Council to hold an election to vote on a by-law to issue $120,000 in bonds, the proceeds to be used for the construction of a new dam, power house and pumping plant. It is proposed to install an electric plant with an output of 1200 hp, of which 500 hp will be used by the water department, leaving 700 hp available for the city.

ST. THOMAS, ONT., CAN.—The Southwestern Traction Company has offered to take over the municipal street railway system in St. Thomas and make certain improvements, providing concessions are granted by the town.

TILBURY, ONT., CAN.—The Council has granted the Tilbury Telephone Company a franchise to erect telephone system in Tilbury.

IBERVILLE, QUE., CAN.—The citizens have voted in favor of establishing a municipal electric light plant in Iberville. It is proposed to install an electric plant in connection with the water-works system at a cost of about $15,000.

AGUASCALIENTES, MEX.—The stockholders of the Aguascalientes Electric Light & Power Company have decided to make extensive improvements to its plant, involving an expenditure of about $100,000. The new equipment will include two Diesel oil engines direct connected to alternating-current generators. The present power plant will be held in reserve after the installation of the new engines.

Company Elections.

HARTFORD, CONN.—At the annual meeting of the Hartford Electric Light Company the following named officers were elected: Austin C. Dunham, president; Samuel G. Dunham, vice-president; John E. Lynch, secretary; D. Newton Barney, treasurer; Frank A. Isleib, assistant secretary and Ernest S. Nutting, assistant treasurer.

LOUISVILLE, KY.—At the annual meeting of the Kentucky Electric Company the following named officers were elected: R. E. Hughes, president; Lawrence Jones, first vice-president; Charles J. Doherty, second vice-president; Bryan H. Allen, secretary and treasurer, and Lewis S. Streng, chief engineer.

ROCKVILLE, MD.—At the meeting of the Washington & Rockville Electric Railway Company the following-named directors were elected: Charles J. Bell, Woodbury Blair, George H. Harries, W. B. Hibbs, William Loeb, Jr., Clarence F. Norment, Ward Thoren, George Truesdell and E. S. Marlow.

MARINE CITY, MICH.—At the annual meeting of the Marine City Roller Mill Company the following-named officers were elected: Alonzo Arnold, president; Andrew Manion, vice-president, and Eber Arnold, secretary, treasurer and manager.

PACIFIC, MO.—At the anual meeting of the Pacific Electric Company the officers were re-elected as follows: A. Koppitz, president; L. P. Gross, vice-president; A. R. Leber, secretary, and L. M. Roemer, treasurer.

SEA ISLE CITY, N. J.—At the annual meeting of the New Jersey Rapid Transit Company the following-named officers were elected: Walker W. Brooks, president; Marshall A. Brooks, vice-president, and M. S. Brooks, secretary and treasurer.

SEA ISLE CITY, N. J.—At the annual meeting of the Sea Isle City Electric Light, Power & Water Company the following-named officers were elected: Walker W. Brooks, president; John W. H. Brooks, vice-president, and M. S. Brooks, secretary and treasurer.

WAUPACA, WIS.—At the annual meeting of the Waupaca Electric Light & Railway Company the following-named officers were elected: Irving B. Lord, president and general manager; C. B. Lord, vice-president; W. H. Lord, secretary, and E. A. Wheeler, treasurer and assistant secretary.

WINNIPEG, MAN., CAN.—At the annual meeting of the Winnipeg Electric Railway Company, William Mackenzie was re-elected president; William Whyte, vice-president; F. Morton Morse, secretary and treasurer, and Wilford Phillips, manager.

YORKTON, SASK., CAN.—At the annual meeting of the Yorkton Northwest Electric Company, J. M. Clark was elected president; T. A. Waterfield, vice-president, and E. N. Dunsford, manager.

New Industrial Companies.

THE DUNBAR ELECTRIC SUPPLY COMPANY, of Oklahoma City, Okla., has been chartered, with a capital stock of $15,000, by G. B. Stone, George Sayles and E. S. Dunbar.

THE L. A. WHITNEY ELECTRIC COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, by Leon A. Whitney, Harry M. Hawes and Edward F. Green, all of New York, N. Y. The company proposes to do general electrical work.

THE POWERS RAILWAY SAFETY APPLIANCE COMPANY, of New York, N. Y., has been chartered, with a capital stock of $30,000, to manufacture railway appliances and mill supplies. The incorporators are: Vance S. Manson, Edward A. Sprong and Samuel S. Ryckman, all of New York, N. Y.

THE COOKE & WILSON COMPANY, of Charleston, W. Va., has been incorporated, with a capital stock of $50,000, to deal in electrical supplies and will operate as manufacturers' agents. The officers of the company are: A. S. Cooke, president; W. J. Wilson, treasurer, and O. F. Scholz, manager.

W. B. GARDINER & COMPANY, of Brooklyn, N. Y., has been incorporated, with a capital stock of $5,000, to manufacture gas and electric fixtures, toys, etc., by William B. Gardiner, Alexander A. Murphy, Jr., and Wright Molineaux, all of Brooklyn, N. Y., and Cornelius J. Haggerty, of New York, N. Y.

THE SCHOONMAKER MECHANICAL MOTOR POWER COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $200,000, by Elmer Schoonmaker, Charles H. Bausher and Stephen G. Stil, all of New York, N. Y. The company proposes to do a general manufacturing business.

THE DRUMMOND-LUDLOW COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $150,000, by B. D. Whedon, Fred R. Bagg, of New York, N. Y., and Mabel V. Warner, of Elizabeth, N. J. The company proposes to engage in the business of mechanical and electrical engineers, tool makers, founders and cutters.

THE MAXIM SPECIALTY COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, to manufacture antiseptic telephone mouth-piece, mechanical contrivances, specialties and devices. The incorporators are: James F. Doran and John C. Doran, of Danbury, Conn.; Max Rosenwald, of New York, N. Y., and David Rosenwald, of Albany, N. Y.

THE POWER ENGINEERING & CONTRACTING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $10,000, for the purpose doing a general engineering and contracting business, including the installation of heating, ventilating and electrical apparatus. The incorporators are: Albert Altman, Augustus M. Dreherand and Emil Herzfeld, all of New York, N. Y.

THE RADIO ELECTRIC TREATMENT COMPANY has filed articles of incorporation, with a capital stock of $300,000, to construct machinery, apparatus and plants whereby "atmsopheric air is automatically incorporated with flowing water and carried into rays of quintescent light." The incorporators are: Samuel Vance, Jr., of Philadelphia, Pa.; William M. Pyle and Edmund S. Hellings, of Wilmington, Del.

New Incorporations.

WILMINGTON, DEL.—Articles of incorporation have been filed for the Northern Idaho & Montana Power Company, with a capital stock of $1,500,000, by I. Milkeurtch, J. S. Cummins, J. J. O'Brien, R. A. Wortman, of Chicago, Ill., and H. W. Davis, of Wilmington, Del.

DES MOINES, IA.—Articles of incorporation have been filed for the Des Moines, Council Bluffs & Western Railway Company for the purpose of constructing a railway from Des Moines to Council Bluffs to be operated by steam, electric or gasoline power. The company is capitalized at $100,000, and the directors are: Robert Pilmer, of Norwalk; A. P. Sawyer, of Pierre, S. D.; W. N. Hansen, H. A. Smith, E. C. Wallace, J. S. Garlock and R. B. Bannister, all of Des Moines, Ia.

POLO, ILL.—The Polo Electric Light & Power Company has been incorporated, with a capital stock of $15,000, by Byron J. Snow, James D. Beckler and William Fraser.

WELLINGTON, ILL.—The Wellington Farmers' Telephone Company has been incorporated, with a capital stock of $1,200, by Monroe Garrison, Daniel Stewart and John C. Benbow.

SHELBURN, IND.—The Central Mutual Telephone Company has incorporated. P. T. Lloyd, H. V. Starke, Elias Moore and W. H. Bennett are directors.

TERRE HAUTE, IND.—The Terre Haute & Southwestern Railway Company has filed articles of incorporation with the Secretary of State, with a capital stock of $50,000. The directors are: H. P. Taussig, H. C. Pugh, R. G. Watson, Robert Herkimer, S, C. McKean, H. B. Bement and Charles Minshall. The company proposes to construct a railway from Terre Haute, through Vigo and Sullivan counties, to the Wabash River, where it forms the boundary line between Indiana and Illinois.

BOLES, KY.—Articles of incorporation have been filed for Boles Home Telephone Company by Otto Maxey, N. S. Renaeu and J. F. Marr.

COLUMBUS, KY.—The Columbus Telephone Company has been incorporated by Charles W. Dupree, Henry Gaylee and J. H. Fisher.

SMITHLAND, KY.—The Union Telephone Company has been incorporated by George W. Jolly, S. S. Miller, J. M. Moore and others.

ERHARD, MINN.—The Edwards Telephone Company has been organized to construct a telephone line to Edwards. E. M. Nelson ,of Frieberg, is president.

PERKHAM, MINN.—Articles of incorporation have been filed for the Perkham Rural Telephone Company by Albert Benke and others to construct telephone lines in the vicinity of Perham.

Legal.

RECEIVER FOR THE NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC COMPANY.—The Maryland Trust Company, of Baltimore, Md., has filed a bill in the Federal Court at Norfolk, Va., for a receiver for the Newport News & Old Point Railway & Electric Company, and for an injunction against the road and its officers. The trust company is trustee of a $4,000,000 general mortgage of the Newport News & Old Point Railway & Electric Company. The petition is asked for the preservation of the assets of the company, which operates an electric railway between Newport News and Old Point.

GEORGIA MANUFACTURING & PUBLIC SERVICE CORPORATION BANKRUPT.—Judge Newman in the Federal Court at Atlanta, Ga., has approved the report of the special master, George D. Anderson, in the case of the Georgia Manufacturing & Public Service Corporation, of Marietta, Ga., and has adjudged the same bankrupt. A petition for a receiver was filed in August, 1908. The company based its objection to the receivership on the alleged grounds that it was principally engaged in furnishing light to the Town of Marietta, whereas the special master found in effect that the manufacture of paper was the principal business of the company.

RULE OF TELEPHONE COMPANY REQUIRING RENTALS TO BE PAID SIX MONTHS IN ADVANCE IS REASONABLE.—In an action brought by a telephone company against one of its subscribers to enjoin him from meddling with the appliances and equipment of the company, one phase was the legality of a telephone company requiring advance payment for service. On this point the court held that the rule followed by the company requiring rentals to be paid six months in advance was reasonable and binding, though it had never been formally adopted. Buffalo County Telephone Company v. Turner, Supreme Court of Nebraska, 118 N. W. Rep. 1064.

CONTRIBUTORY NEGLIGENCE IN TAKING HOLD OF BROKEN ELECTRIC LIGHT WIRE.—The plaintiff in an action against an electric light company was a man about 25 years of age. On July 4, 1905, while sitting in a public park, he saw some boys playing with a broken electric light wire by placing sticks on the exposed end of the copper wire where the latter was stripped of its insulation covering. He walked over to where they were, saw that the wire was emitting sparks, and that it burned the sticks pressed against it. It was very apparent, and the plaintiff knew, that this was a broken electric light wire, and at the time charged with a heavy current of electricity. Without saying anything to the boys who were playing with the wire, and after waiting and apparently watching their antics for about half a minute, he stooped down and took hold of this wire with his left hand at a place where it was coated with insulating material and some two feet from the exposed and sparking end, for the purpose of throwing it over the branch of a nearby tree and thus saving the surrounding youngsters from possible injury by contact with the wire. He thought he could safely do this, but he was severely shocked and also had his left hand badly burned. "The distinctive feature of this case," said the court, "is that the plaintiff knew he was taking hold of a live wire heavily charged, had before him actual demonstration of its condition, and yet intentionally and unnecessarily, but from good motives, grasped the wire, assuming, without any real knowledge, to know that he would be protected by the insulating cover upon the wire." The plaintiff was found guilty of contributory negligence in taking hold of the wire, and was, therefore, not allowed to recover damages. Billington v. Eastern Wisconsin Railway & Light Company, Supreme Court of Wisconsin, 119 N. W. Rep. 127.

Personal.

MR. L. R. McCLEARY, of Niagara Falls, N. Y., formerly with the Ontario Power Company, has been appointed manager of the Falls Power Company, of Welland, Ont., Can.

MR. CLIFTON R. HAYES, formerly superintendent of the Fitchburg Gas & Electric Light Company, Fitchburg, Mass., has been appointed to the position of general manager of the company.

MR. FRANCIS S. THAYER, superintendent of the Clinton and Leominster plants, owned by the Massachusetts Lighting Companies, of Boston, Mass., has resigned his position. Mr. Thayer will be succeeded by George B. Spring, superintendent of the Ayer Electric Company, Ayer, Mass.

MR. CURTIS C. COOK has resigned his position as secretary and assistant treasurer of the Hartford Electric Light Company, of Hartford, Conn. Mr. Cook has been with the company about 16 years and for nine years has been an officer. Mr. John E. Lynch has been appointed secretary to succeed Mr. Cook.

SIR CLIFTON ROBINSON, well known in traction work on both sides of the Atlantic, and head of the London United Electric Tramways, is the subject of a biographical sketch in London *Vanity Fair* of Feb. 3, accompanied by one of the colored full-page, full-length portraits by "Spy," for which that journal is famous.

MR. H. E. LAVELLE, who for the past four years has been associated with the Electric Service Supplies Company, and was previously with the Mayer & Englund Company; also in the past with the Western Electric Company and Machado & Roller, will sever his present connection about March 1. Mr. Lavelle has as yet made no plans for the future.

DR. E. G. ACHESON.—At a convocation of the University of Pittsburgh, held in Carnegie Music Hall in that city on Lincoln's birthday, Feb. 12, several degrees commemorating the occasion were conferred by Chancellor McCormick. Mr. E. G. Acheson, the well-known engineer and inventor of carborundum, etc., was made a doctor of science. Mr. Acheson, now president of the American Electrochemical Society, was long a resident in Pittsburgh and did much of his original work there in electrochemistry, etc.

MR. HAROLD E. YOUNG has been appointed chairman of the Electric Light Commission, which was authorized by the Board of Aldermen of Manila, P. I., as the result of the agitation of the lighting question in that city. Mr. Young, who is a graduate of the Massachusetts Institute of Technology, was until recently connected with the engineering department of the American Telephone & Telegraph Company. He is at present occupying the position of electrical engineer of the city of Manila.

MR. ROBERT TODD LINCOLN, surviving son of Abraham Lincoln, whose centenary was so widely celebrated last week, is the first vice-president of the Commonwealth Edison Company, of Chicago. He is also a director and a member of the executive committee. Mr. Lincoln is a lawyer by profession and a man of large interests, being president of the Pullman Company. He has an impressive personality, with courtly manners and a retiring disposition. He is said seldom to mention his father, whose death appears to have made a profound impression on his life. He is not active in the administration of the Commonwealth Company, but he is nevertheless thoroughly conversant with its affairs and a regular attendant at board meetings. His interest is shown by the fact that a number of years ago, when minister to Great Britain, he retained his directorate in the Chicago Edison Company (predecessor of the Commonwealth Company), although he resigned nearly all the other offices which he held.

Obituary.

MR. T. LOWRY.—We regret to note the death of Mr. Thomas Lowry, president of the Twin City Rapid Transit Company, of Minneapolis, in that city, on Feb. 4. Spending the early part of his manhood in the practice of the law, he became identified with street railway development in 1873, and then was one of the first to recognize the merits of electric traction. In 1890 he served as president of the American Street Railway Association, in which he took a deep interest. He was one of the public utility managers who was deservedly popular and esteemed in the community in which he lived. His age was 66.

Trade Publications.

PORCELAIN.—Porcelain for all electrical purposes is covered in the 1908 catalogs of the G. F. Brunt Company, East Liverpool, Ohio.

FAN MOTORS.—The General Electric Company, Schenectady, N. Y., has issued a booklet giving prices and data relating to its fan motors of all types.

GRAPHITE for motor lubrication is discussed in an instructive manner in a booklet issued by the Joseph Dixon Crucible Company, Jersey City, N. J.

ELECTRIC IRONS are attractively presented in the January issue of *Hot Points*, published by the Pacific Electric Heating Company, Ontario, Cal.

LIGHTING SPECIALTIES.—The February issue of "Juice," the monthly publication of the Pettingell-Andrews Company, Pearl Street and Atlantic Avenue, Boston, describes many lighting specialties that have been produced so recently that they have not been covered in trade catalogs.

DIRECT-CURRENT MOTORS, rated at from 0.125 hp to 7.5 hp, are illustrated, described and listed in a booklet issued by the U. S. Electrical Manufacturing Company and Dynamo Electric Machine Company, 214 South San Pedro Street, Los Angeles, Cal. An interesting device also described is a fan which can produce either a cooling or a warming breeze.

HIGH-VOLTAGE SWITCHES.—Bulletin No. 4 of the Kelman Electric & Manufacturing Company, 612 North Main Street, Los Angeles, Cal., contains descriptions with numerous dimensional illustrations of high-voltage oil switches and oil circuit-breakers. The devices are of the automatic and non-automatic, electrically operated and manually operated types for e.m.f. up to 110 volts.

SPRAY PUMPS.—The Deming Company, Salem, Ohio, has issued a handsome catalog giving full details of its spray pumps, nozzles and appliances. These pumps are designed for such work as whitewashing in mills, factories and warehouses. The catalog contains a 12-page spraying chart; it gives sectional and detailed views of several of the pumps, and illustrates many of them in action.

MACHINE TOOLS.—Edition D of the illustrated catalog of the Garvin Machine Company, Spring and Varick streets, New York, is devoted to Lincoln and duplex milling machinery, profiling machinery, vertical spindle milling machinery, Universal cutter and tool grinder, vertical, horizontal and automatic tapping machines, duplex drill lathes and gang drills. The catalog is printed in English, German and French.

GAS PRODUCERS.—A 160-page publication dealing with producer-gas power plants, producers for metallurgical use, and applications of producer gas has been issued by R. D. Wood & Company, Philadelphia. The book is of a character somewhat different from the usual trade publication in that it contains much valuable technical data presented in text-book form. The book should prove of much value for reference by engineers and users of gas producers.

Business Notes.

THE JOHNS-MANVILLE FACTORY at Milwaukee was destroyed by fire on Feb. 13. One employee and four firemen lost their lives.

THE HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, N. H., has opened an office at 1931 Broadway, which will be in charge of Mr. R. V. Sutliffe as branch manager.

THE PACIFIC ELECTRIC & MANUFACTURING COMPANY has changed its address to 80 Tehama Street, San Francisco, where hereafter will be located both its factory and office.

INDIRECT ILLUMINATION.—The National X-Ray Reflector Company, of Chicago, has equipped the new offices of the North Shore Electric Company with its indirect (I-Comfort) system of lighting.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, of Chicago, has a special bulletin giving the new prices on Crescent insulated wire and lamp cord, for which they are the Western agents. They will be glad to send these to any who are interested.

THE HESS-BRIGHT MANUFACTURING COMPANY has removed its New York office from 90 West Street to 1974 Broadway, near Sixty-sixth Street, where a store will be opened which will carry a complete stock of Hess-Bright ball bearings and magnetos.

THE MARSHALL ELECTRIC COMPANY has moved its office and factories to the new reinforced-concrete, fireproof building which it has erected and equipped at Hyde Park, Mass. Owing to the increasing business of the company, more commodious quarters became necessary, and the new building is the result.

GOVERNOR-PIN LUBRICATION.—The Keystone Lubricating Company, Philadelphia, manufacturers of Keystone grease, has recently been advised of the efficiency and economy of this product in the lubrication of governor-pins of an installation of Westinghouse high-speed engines at the plant of the Electric Storage Battery Company, Philadelphia. In this type of flywheel governor the conditions of safe and effective lubrication are severe, as the governor-pin carries a pair of heavy weights and oscillates through a short arc only for its maximum travel between light load and full load on the engine. The chief engineer, reporting on the performance of the grease, states that it gave perfect satisfaction with a consumption of 4 to 6 ounces of No. 2 density grease on each engine per week of 13 consecutive shifts.

ALLIS-CHALMERS PUBLICATIONS.—A recent list of publications issued by Allis-Chalmers Company shows 187 bulletins and instruction books which that company has prepared, or has in course of preparation, exploiting the products of its various departments, which include the manufacture of prime movers of every description, electrical apparatus for alteranting and direct current, pumping machinery, mining machinery, crushing and cement making machinery, flour mill machinery, saw mill machinery, etc. Information descriptive of all of the above is indexed in a convenient manner for reference. The publications are illustrated by cuts of the most modern appliances and methods, and in addition to the descriptive matter, which can be had on application, the index of publications contains the numbers and titles of several useful instruction books.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 9, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

911,565. ALARM AND TELEPHONE SYSTEM; G. Babcock, Rochester, N. Y. App. filed Dec. 2, 1904. Combined fire alarm, police signal and telephone; improvement on 807,235. A police signal and telephone equipment of special type is provided so that the policeman must necessarily actuate the signaling mechanism in making his round, thus informing the office which policeman has operated a particular box.

911,578. ELECTROPLATING APPARATUS; J. T. Daniels, Newark, N. J. App. filed Aug. 27, 1907. The walls of the drum are made of celluloid instead of wood.

911,592. MULTIPLE SWITCH-STARTER; J. T. Janette, Milwaukee, Wis. App. filed May 20, 1907. Avoids burning out the starting resistance by a failure to close all of the switches by providing interlocks between the switches whereby each switch after the first holds the preceding switch in a closed position. The switches are closed hand over hand and the last switch is retained in position by a retaining magnet. If the operator fails to close all the switches and removes his hand from the switch last closed, all the switches are opened, the starting resistance reinserted and the motor circuit opened.

911,618. AUTOMATIC ADVERTISING OR DISPLAY APPARATUS; H. M. Scutz, Milan, Italy. App. filed Feb. 11, 1905. The lamps are carried on plates which are driven by machinery so as to describe certain eccentric and concentric evolutions.

911,623. RAILWAY-CROSSING SIGNAL; H. W. Souder, Tamaqua, Pa. App. filed May 20, 1907. Protects the crossing between a steam and trolley road by a variable signal normally at danger and an insulated rail section on the main road, together with signal actuating means extending a certain distance from the crossing along the crossing road and operated by the trolley car, together with means for insuring the retention of the signal at danger while the car is in the insulated section.

911,645. COUPLING; T. W. Christian, Chicago, Ill. App. filed May 11, 1908. Makes use of hooks on one end of one conduit section and a web on the companion member entering between the hooks. Details.

911,687. HOT-AIR SYRINGE; H. E. Vogel, Chicago, Ill. App. filed Nov. 8, 1905. An electric heater located in the handle of the syringe suitably controlled by push-buttons heats the air.

911,698. CIRCUIT-CONTROLLER FOR TROLLEY-SIGNALS; A. Bevan, Providence, R. I. App. filed March 23, 1908. The circuits for the signals are controlled by a lever hanging in the path of the passing trolley wheel. Means are provided whereby the actuation of either circuit-closer by the wheel locks the other.

911,708. DYNAMO-ELECTRIC MACHINE; B. Elshoff, Norwood, Ohio. App. filed June 30, 1906. Means for supporting and bracing the end-turns of the stator coils by an outer bracing ring of insulating material, an inner insulating bracing ring concentric with the former, together with means for drawing the rings together to clamp the conductors between them.

911,713. METHOD OF AND MEANS FOR SECURING IN POSITION CONDUCTORS OF ELECTROMAGNETIC STRUCTURES; B. Frankenfield, Norwood, Ohio. App. filed May 3, 1906. Holds the armature coils or field coils of a machine in place by means of a laminated slotted core in which the coils are located; some of the laminæ having teeth split at the ends and spread apart over the conductors so as to secure them in position.

911,714. TELEPHONE; O. Frazier, Brazil, Ind. App. filed March 2, 1907. Amplifies the effect of the voice on the receiver diaphragm by using an additional circuit and coil which are under the control of the receiver-hook and cut in when the receiver is placed on the hook.

911,723. INTERLOCKING MACHINE; J. S. Hobson, Edgewood Park, Pa. App. filed Sept. 14, 1908. Insures that the operator closes the circuit on the electric lock before he attempts to move his lever, thus avoiding binding the latch of the electric lock. Makes use of a circuit-controller operated by the lever to close the circuit on the electric lock to release the lever.

911,730. FIRE-ALARM; Verner Kall, Rockford, Ill. App. filed July 8, 1908. The alarm is actuated by means of a circuit-closing wheel which is controlled by a bolt held by a cord. When the cord burns, the bolt is withdrawn and the wheel gives the alarm.

911,746. RELAY; Edward McClintock, St. Paul, Minn. App. filed Jan. 16, 1906. The relay consists of one or more hollow rings on a horizontal shaft between the pole pieces of an electromagnet. The rings are half full of a conducting fluid which closes the contacts at the proper time.

911,753. DISAPPEARING MANHOLE-GUARD; R. Parks, Denver, Col. App. filed Aug. 5, 1907. Particularly for the upper floor of a fire-engine house through which the pole passes upon which the men slide to the floor below when an alarm is given. Makes use of a trap-door to close the opening which is automatically removed by electrical connections and a weight when the alarm is given.

911,758. COMMUTATOR CONSTRUCTION; H. H. Ralston, Norwood, Ohio. App. filed May 31, 1907. The commutator bars are clamped in place by means of a spider and a ring of insulating material between the spider and the bars. The clamping ring is made in sections so that a section may be removed in order to get at the bars for repairing.

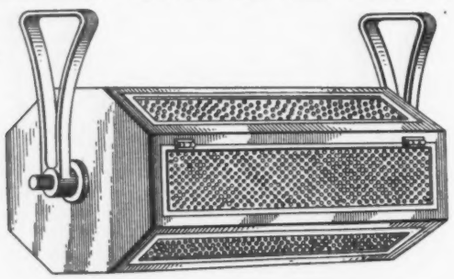
911,774. PHANTOM ELECTRIC CIRCUIT; H. B. Stone, Providence, R. I. App. filed Nov. 26, 1907. Relates to repeating coils in telephone systems so as to permit the use of the main circuits for direct signaling.

The repeating coil has three windings, two of them balanced and so arranged that the third winding will induce currents in the two balanced windings and in the two conductors of the circuit, which are alike in direction and intensity.

911,797. DYNAMO-ELECTRIC MACHINE; E. C. Wright, Newport, Ky. App. filed Jan. 22, 1906. Provides separable pole pieces so as to be able to get at the main and auxiliary windings without removing or disturbing the main field coils or the distributed balancing winding.

911,798. TELEPHONE-EXCHANGE SYSTEM; W. A. Wynne, Raleigh, N. C. App. filed July 29, 1908. Calling subscribers may be answered quickly by providing a special line relay for each line which is energized when the line calls. To the normally open contacts of these relays the circuit of the operator who is to answer the group is connected.

911,844. ARMORED PLUG-RECEPTACLE; R. A. Schoenberg, New York, N. Y. App. filed June 22, 1908. A detachable armored molding receptacle, having an inside hollow metal sheath with apertures adapted



911,578—Electroplating Apparatus.

to be detachably secured to the molding, together with an insulating block secured to the molding and covered by the sheath.

911,847. ELECTRICAL TROLLEY-REPLACER; H. L. Sparks, Palestine, Tex. App. filed May 4, 1908. The trolley is replaced by compressed air controlled by a valve which is in turn controlled by an electromagnet.

911,850. BATTERY-CHARGING SYSTEM; W. I. Thomson, Newark, N. J. App. filed Aug. 29, 1905. Means are provided so that when a load is cut in parallel with the battery the current through the battery remains unchanged. A current-utilizing device may be put in circuit with the battery, together with means for regulating the output of the source of current, including a solenoid and a shunt about the solenoid. A single means simultaneously closes the circuit of the shunt and throws the current-utilizing device into circuit.

911,854. CONDUIT-ROD; E. L. Upson and F. J. Dole, Brooklyn, N. Y. App. filed Jan. 11, 1907. A coupling for the sections of a conduit-rod, each having a sleeve for the reception of the rod section and a cutaway portion at one side thereof and opening into the sleeve for the passage of a fastening means, together with a fastening inserted thereinto through the cutaway portion after the parts are assembled.

911,864. PORCELAIN CLEAT; Esar Haddon Ball, Cedar Rapids, Ia. App. filed Aug. 6, 1908. The base member is provided with a mortise and the cap member is composed of two sections each provided with a tenon adapted to engage the said mortise.

911,866. DESK-TELEPHONE; E. R. Corwin and C. A. Bals, Chicago, Ill. App. filed March 28, 1908. Comprises a base portion with the usual vertical standard which carries a telephone receiver-hook. Switch contact members are carried on a removable plate, which is held in place by springs. A spring-pressed rod passes from one of the switch contacts to the hook.

911,878. ELECTRIC-CONTROLLING SYSTEM; D. C. Jackson, Brookline, Mass. App. filed Nov. 2, 1907. Automatic starter for electric motors. A plurality of electric switches, each controlled by an electromagnet, is provided, which successively cut out the sections of a starting rheostat. Details.

911,921. CIRCUIT-CLOSER FOR FIRE-ALARM CIRCUITS. R. D. Tiffany, Bellingham, Wash. App. filed May 29, 1908. Includes a container, for an expansible fluid, shaped like a bottle with a plunger working in the neck of the bottle. The plunger carries a contact and is actuated by the fluid to close the circuit at the desired time.

911,932. SYSTEM OF MOTOR CONTROL; G. F. Atwood, New York, N. Y. App. filed June 8, 1907. The selector arm is driven by an electric motor and means are provided whereby at each contact of the arm with a terminal the direction of rotation of the motor is reversed.

911,943. CIRCUIT-CLOSER; A. B. Culver, Aguascalientes, Mex. App. filed Aug. 24, 1908. A rotating timer for internal-combustion engines in which the shaft carries a ball and a brush at opposite sides thereof, the ball making contact and the brush dusting off and cleaning the contact surface against which the ball rolls.

911,948. ELECTRIC RAILWAY SYSTEM; W. E. Dawkins and J. W. Dawkins, O'Fallon, Ill. App. filed Feb. 21, 1908. Avoids the use of an underground system or an overhead trolley by laying the feed-wire on the surface of the ground. A blade on the car engages successive contact rollers, which, in turn, are connected to the wire. The contact roller is protected by insulated disks loosely mounted on the roller.

911,968. MULTIPLE CALL-BELL SWITCH; LeRoy I. Freas, Chalfont, Pa. App. filed May 11, 1908. A plurality of bells have their terminals connected to a plurality of contacts arranged around the periphery of a circular block of wood. A selecting arm pivoted to the center of the block can be rotated about the block to successively depress plungers into connection with the contacts so as to ring any desired bell.

911,973. INSULATING HIGH-VOLTAGE TRANSMISSION LINES; W. T. Goddard, Victor, N. Y. App. filed Aug. 22, 1908. A high resistance is interposed in series between the line wire and a support connected with the earth.

912,024. MEDICAL IMPLEMENT; W. M. Parks and B. B. Cross, Gas City, Ind. App. filed May 13, 1908. A hood surrounds an incandescent lamp, the bottom of the hood being open. The walls of the hood have an air space between them. Details.

912,029. TELEGRAPHIC KEY OR TRANSMITTER; H. O. Putt, Millbury, Ohio. App. filed Feb. 17, 1908. The key lever is provided with a spring carrying a supplemental contact for the production of the dot impulses and has a weighted end, so as to be capable of rapid vibration when once set in motion in order to permit a number of closures of the circuit, thus giving a number of dots.

912,037. ELECTRIC MOTOR; G. Seidel, Saunderstown, R. I. App. filed Aug. 5, 1908. The motor has a rocking armature and a permanent field magnet. The polarity of the armature is periodically reversed so as to rock it by the action of its poles on the permanent magnet.

912,055. SELF-RESTORING TROLLEY; J. T. Andrew, Montgomery, Ala. App. filed April 30, 1908. The trolley wheel is made up of a plurality of wheels side by side, which periodically raise the trolley so as to force it into the slot of the central trolley wheel, when the trolley leaves it.

912,074. MOTOR CONTROL; H. H. Clark, Schenectady, N. Y. App. filed July 26, 1906. For controlling induction motors, particularly when operating mine hoists or variable loads. A resistance or impedance is in circuit with the motor, controlled through a switch from the source of mechanical power by a slipping clutch, which, in turn, is controlled by the amount of motor current.

912,079. RELAY; F. B. Corey, Schenectady, N. Y. App. filed June 1, 1906. Means for supporting the terminal binding posts of the relay by utilizing a flange of insulating material extending beyond the magnet coil for supporting the posts.

912,128. CONTROLLING-SWITCH; G. H. Hill, Schenectady, N. Y. App. filed Oct. 11, 1906. Instead of using a single switch for effecting the series-parallel control, makes use of two switches, one of which makes the series-parallel connection and the other varies the resistance in the circuit, together with suitable connections between them.

912,144. MULTIPHASE ELECTRIC INDUCTION-MOTOR; H. A. Mavor, Mile End, Glasgow, Scotland. App. filed April 17, 1908. Controls the speed of these motors by surrounding the rotor with a revoluble induction element and provides a controlling multiphase induction-motor with a secondary element in connection with the first-named element, together with means for holding the former induction element stationary and releasing the same when starting the controlling motor.

912,159. SIGNAL; W. H. Parrish, Jr., Nashville, Tenn. App. filed May 2, 1908. Improvement on 847,105, for protecting a crossing between electric and steam roads so as to control the electric train. Includes a semaphore operated by one train to signal the crossing train with means for moving the semaphore to danger in the event of a defect in the first-named means.

912,190. TROLLEY-WHEEL; I. O. Stant, Dublin, Ind. App. filed March 3, 1908. The trolley-wheel has at each side thereof a cone wheel idler provided with intersecting spiral grooves running in opposite directions, so as to replace the trolley wire. Details.

912,209. RADIO-TELEGRAPHY; H. R. Von Traubenberg, Berlin, Germany. App. filed Feb. 10, 1908. The arc-lamp which produces rapid electrical oscillations has its electrodes provided with cooling ribs to dissipate the heat.

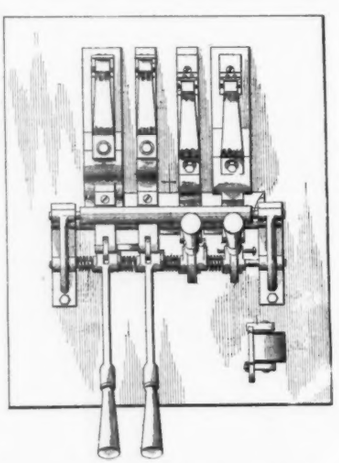
912,235. ELECTRIC CLOCK; H. H. Engelberg and C. Wagner, Danville, Pa. App. filed June 21, 1905. The making and breaking of the circuit places a coil spring under tension to wind the clock. This is accomplished by an armature controlled by a magnet. Details.

912,237. BINDING-POST; J. W. Feerrer, Boston, Mass. App. filed June 4, 1907. The binding-post has a spring-pressed jaw between which and a companion jaw operated by a lever the wire is placed.

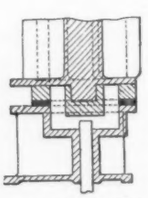
912,242. ELECTRIC STORAGE BATTERY; H. K. Hess, Philadelphia, Pa. App. filed Sept. 24, 1907. The grid consists of a rectangular open frame made of contacting lead strips secured together face to face and another series of lead strips arranged in horizontal tiers, one above the other, with their intermediate portions bent in the form of upright open loops.

912,245. SOLDER FOR INCANDESCENT-LAMP FILAMENTS; H. Kuzel, Baden, near Vienna, Austria-Hungary. App. filed Jan. 19, 1906. The solder consists of a carbide of tungsten and the carbon given off forms carbides of the metal.

912,246. MANUFACTURING ALLOYS; Hans Kuzel, Baden, near Vienna, Austria-Hungary. App. filed March 26, 1907. For the manufacture of alloys for incandescent-lamp filaments or the like. Precipi-



911,592—Multiple Switch Starter.



912,209—Radio-Telegraphy.

tates from a mixture of a colloidal suspension and a crystalloidal solution the desired alloy and heats the mass to reconvert it into the crystalloidal state.

912,247. METAL-FILAMENT ELECTRIC GLOW-LAMP; Hans Kuzel, Baden, near Vienna, Austria-Hungary. App. filed Nov. 24, 1908. Prevents contact between the filaments by connecting the tops of the filaments by substantially straight portions meeting the top at an angle.

912,267. RESISTANCE; T. Von Zweigbergk, Preston, England. App. filed Nov. 28, 1906. The resistance consists of a series of grids separated by insulation, formed with slots alternately from opposite sides and are independently supported so as to provide ventilation space between them.

912,268. SYSTEM FOR METERING SERVICE ON THE LINES OF TELEPHONE EXCHANGES; C. M. Beattie, Rochester, N. Y. App. filed Sept. 9, 1907. A meter actuated when the telephone circuit is closed to show the number of calls and a separate meter for recording the length of time the line is in use.